

Consulting Engineer



April, 1958

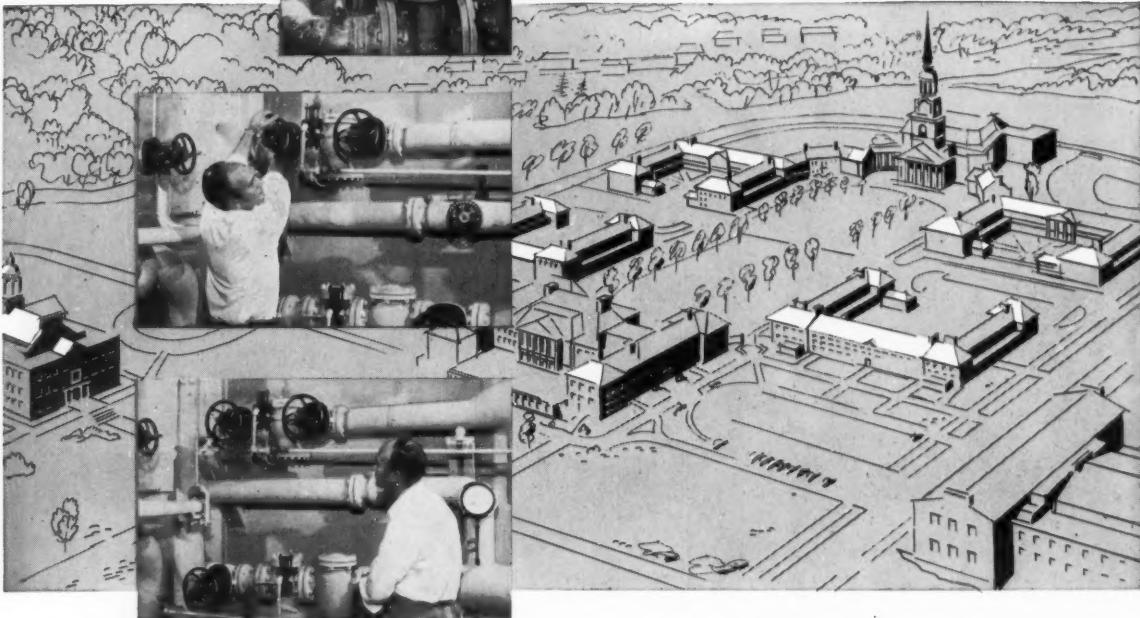


THOMAS N. ARNOLD, consulting engineer, of Auckland, New Zealand, is a member of a pioneer family in a land where engineers still rely on the ingenuity associated with pioneers. The youngest consulting engineer in the country when he formed his own firm in 1950, Arnold is a fourth-

Continued on page 8

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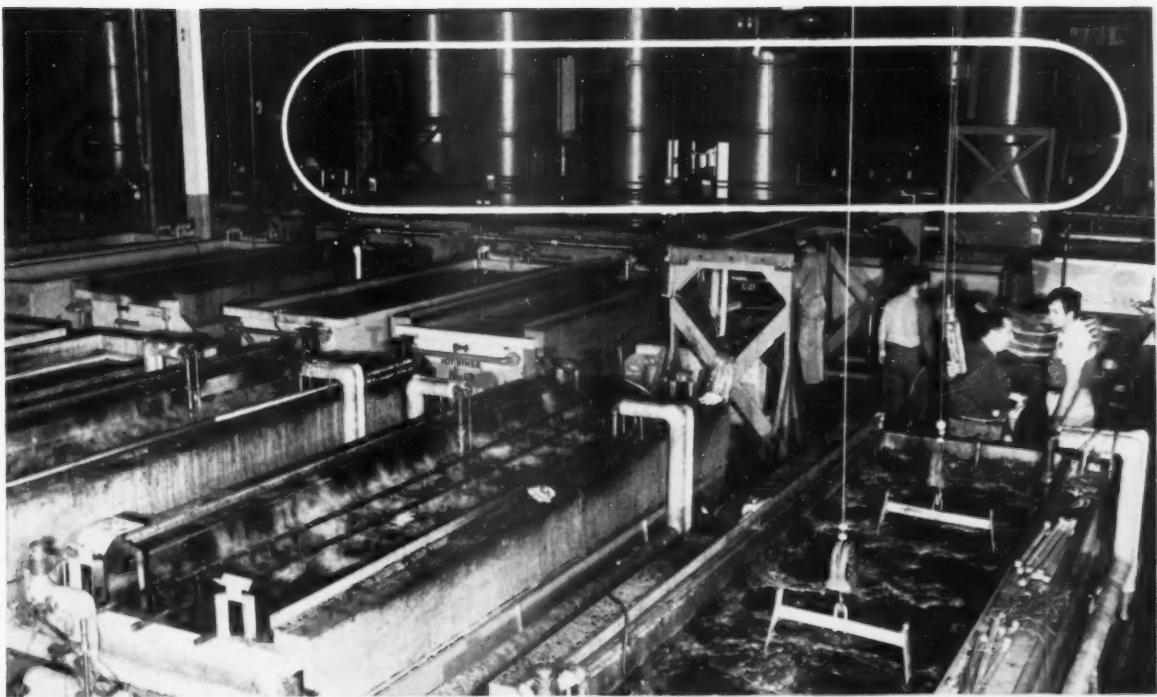
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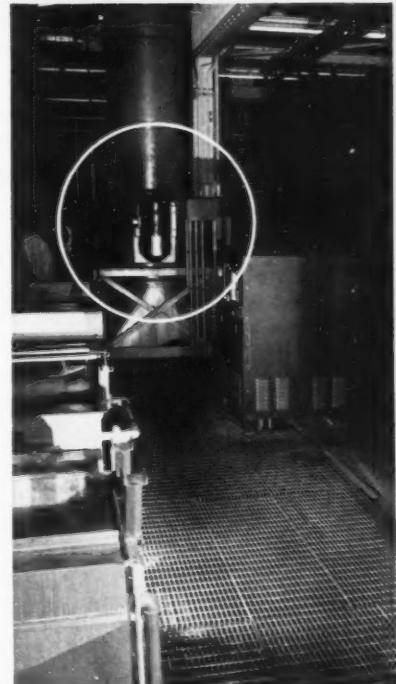
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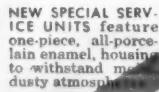


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Consulting Engineer

The Consulting Engineer's Professional Magazine

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April, 1958 • VOLUME X • NUMBER IV

- | | |
|----------|--|
| ARTICLES | 88 How B & V Handle Drawings and Reports <i>A. V. Ferry</i> |
| | 92 Designing an Underground Building <i>Ralph S. Torgerson</i> |
| | 96 My Approach to High Frequency Lighting <i>Carl R. Albach</i> |
| | 102 Setting Up a Computer Center <i>Edgar C. Richardson</i> |
| | 107 Industrial Power Plants . . . A Series of Project Studies <i>With Introduction by Alf Kolflat</i> |
| | 122 Here's How Krick Predicts the Weather <i>Staff</i> |
| | 133 Report from Belgium <i>John Ashton</i> |

| | |
|-------------|------------------------------------|
| DEPARTMENTS | Cover Personality—Thomas N. Arnold |
| | 16 Readers' Comment |
| | 28 Readers' Guide |
| | 34 Scraps and Shavings |
| | 39 Heard Around Headquarters |
| | 54 Report From the West Coast |
| | 75 Legal Aspect |
| | 82 The Word from Washington |
| | 140 Atoms in Action |
| | 150 Report From the East Coast |
| | 159 Beyond Our Borders |
| | 177 News for the Consultant |
| | 192 Men in Engineering |
| | 198 New Projects Reported |
| | 214 Books |
| | 220 Meetings |
| | 222 Advertisers Index |

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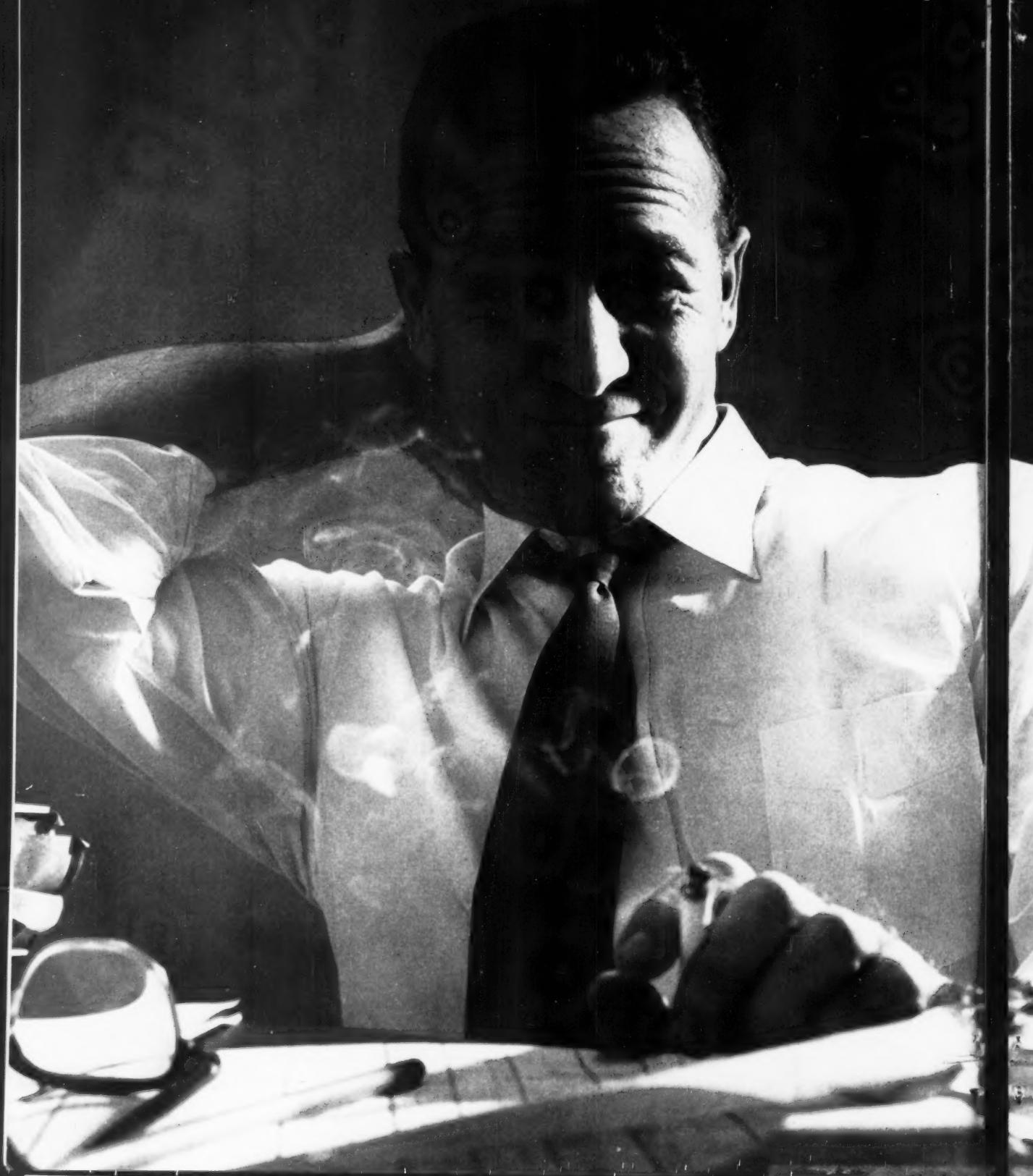
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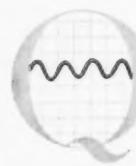


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Thomas N. Arnold

-Starts on front cover

generation New Zealander—about as far back as New Zealand had pioneers.

Thinly populated (about 2 million people in a land area approximately the size of Great Britain), New Zealand supports one of the highest living standards in the world, and is now in the midst of a self-financed public works program, including an \$80-million road project.

With only 1200 registered engineers, there is work for all. However, the government dominates the engineering field, with 85 percent of all engineers working for governmental bodies, 10 percent for industry, and the remaining 5 percent in private practice. "The situation has been like this in New Zealand for as long as I can remember."

The reason so many New Zealand engineers work for the government is that their cadet work (an internship) is for a governmental body, and they often go on to make a career of it. Young engineers must work as cadets before they can be registered with the British Institution of Civil Engineers. There is no registration law, registration being within the Institution rather than by statute.

Cadets take an examination and report on a project they designed or supervised to become an associate member of the Institution. If they pass, registration is automatic. Otherwise they take additional examinations until they do pass.

Some 40 percent of the consulting engineers are graduates of the University of New Zealand. The remainder have obtained their registration the hard way—by attending night school and working under an Institution member. These jobs are arranged under the auspices of the Institution.

Arnold firmly believes "it is the engineer's capacity, not his college degree, that counts," but this is a controversial subject in New Zealand.

Arnold thinks a young man starting in the engineering profession should be encouraged to get some understanding of engineering at an early age. "Only rarely does the average university graduate get this chance until he is older, because the heavy emphasis in our schools is on theoretical training."

The ideal arrangement, Arnold believes, is for the young man leaving secondary school to spend about two years in a drafting office grasping the fundamentals and general routine, laying the foundation for an appreciation of a college education.

By a combination of practical experience and a good theoretical background, Arnold feels, self-reliant engineers could be produced—men with powers of mature judgment developed early in life.

"Today, more than ever before, engineers in all parts of the world are characterized by an attitude

of extreme caution, based, possibly, on an overdose of theoretical training. Many do not have the faculty for assessing the over-all picture in the right perspective," Arnold said.

"Some of the greatest engineering works of the world were built by men with a fraction of the theoretical knowledge accumulated today, but with adventurous minds and acutely developed powers of judgment."

Problems in New Zealand

Since the New Zealand government employs 85 percent of the country's engineers, it uses these men whenever possible instead of hiring consultants. When the government does hire a consultant, it frequently retains one from overseas, usually England. Arnold explained that the government wants the large projects completed as soon as possible and feels that foreign consultants, with large staffs, can complete them faster than local engineers.

This becomes a vicious circle. Without large jobs New Zealand consultants cannot afford large staffs. Not having large staffs they cannot get the important design projects.

Arnold has worked out his own answer to this problem. Instead of forming a partnership or a corporation, he operates with "associates." For any given project, he teams up with other engineers on a share basis. These men, each with a personal and professional interest in the specific project, operate as temporary partners.

The engineer awarded the contract has over-all responsibility and gets the largest share of the profits. Draftsmen are hired by the hour as needed.

In New Zealand's rapidly changing economy, Arnold's system has the advantage of practically eliminating overhead. And working in collaboration with experts in fields chosen as the projects demand, Arnold can offer services on as large a variety of projects as he could by keeping a large staff of his own.

"Hawking a job" (getting it on a basis of a price bid) is a rare thing in New Zealand, and "is given a very poor reception by all reputable engineers," Arnold said. The New Zealand Professional Engineers Association has a scale of recommended fees, and this is followed very closely. "We feel that any relaxation of this principle is harmful to the status of our profession."

Because of the scarcity of government contracts, much of the consultant's work is for architects. The customary fee to architects is usually 4 to 6 percent of the actual cost of the structural work on a project. Most consultants have a core of permanent architect clients, resulting in sought-after stability.

At present, the 30 consulting engineers in New Zealand form a division of the Professional Engi-

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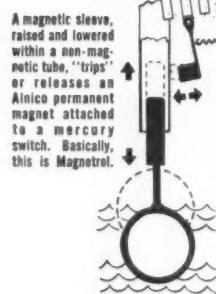


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neers Association. However, some consultants feel (like many of their United States counterparts) that an independent group would be preferable. "The feeling is the Professional Association is too heavily dominated by the civil service," Arnold said.

The consultants get together to discuss mutual problems, but on an informal basis. Annual "buck cuttings" (stag picnics) are held, "where some harsh soul-searching is done and a lot of erroneous impressions are scuttled." Arnold said these meetings are purposely the most informal of all engineers' meetings in New Zealand, because sharing leisure hours results in closer acquaintanceships, "to our mutual professional benefit."

The same spirit of working together is evident in all walks of New Zealand life. In developing a new country with limited financial potential, price is important. As a result, everyone (and particularly the engineer) is expected to improvise, making the best possible use of available materials.

"This probably accounts for the fact that New Zealand engineers continually investigate and develop new ideas and techniques," Arnold said.

Aluminum Bridge Design

Arnold's own career is a good example. For a number of years he has been interested in portable bridges for New Zealand highways. His idea was to design a bridge of permanent material fully transportable in one piece, and sufficiently light for handling by modern equipment and a few men. He selected high-tensile aluminum alloy designed to H20-516 highway loading capacity.

Initially, some New Zealand officials were a little cautious about investing the money necessary to try out Arnold's idea. They were particularly doubtful about the use of aluminum, which must be purchased in Canada, extruded in England, and shipped to New Zealand . . . but it still is cheaper than steel and other bridge materials.

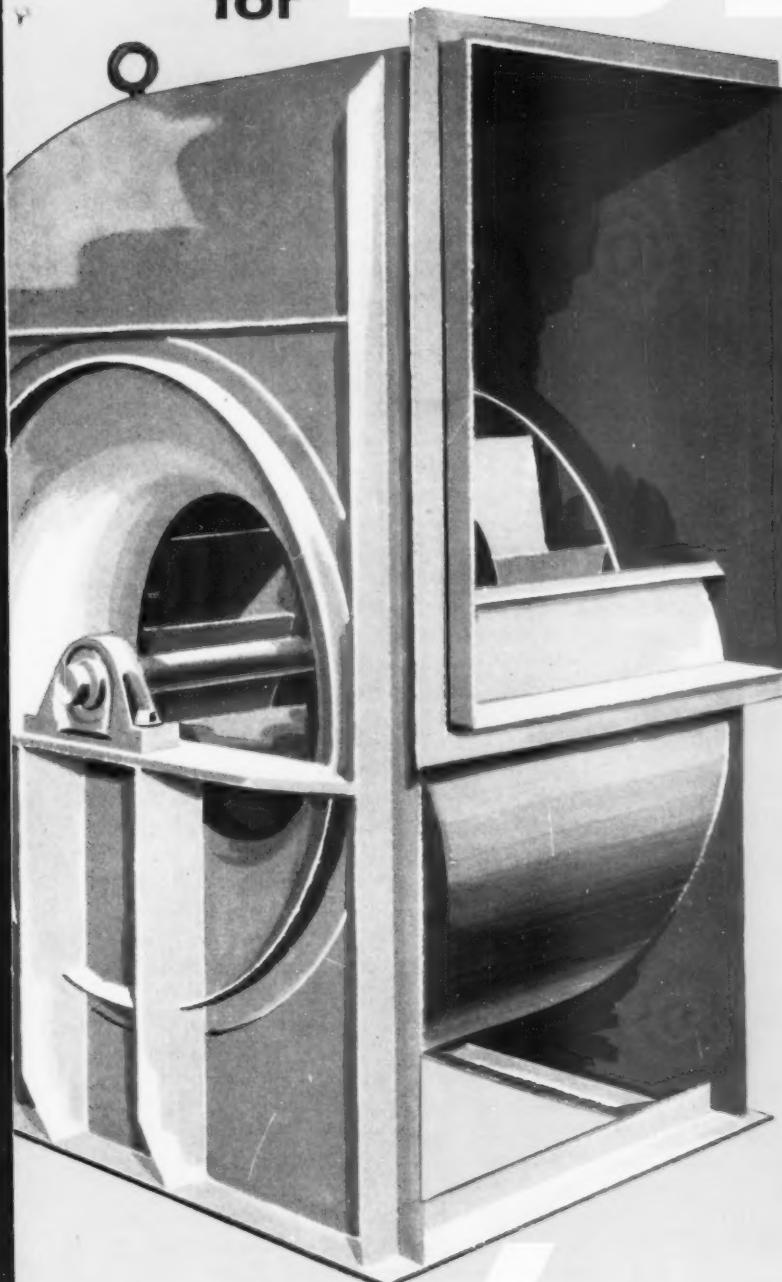
Finally, he was able to design and build an aluminum-alloy bridge for one of the highways leading into Wellington, New Zealand's capital, with the understanding that the bridge could be subjected to a 50 percent overload. If any structural damage occurred, Arnold was to pay for repairs.

As Arnold put it, "Few small bridges have been subjected to such stringent tests."

One test involved a loading with the heaviest highway grader and compactor available. The compactor-grader crossed at full speed — so fast it touched the bridge only three times in its passage."

Arnold, in understatement matching his British accent, noted that "the combination bounced onto the bridge with considerable gusto. It was quite frightening for the recorders crouched below." Underneath, the nervous recorders measured the im-

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pact at twice the maximum for which any highway bridge need be designed.

Long-term testing continues on this bridge. To date 1.5-million vehicles have passed over it. Arnold said that patent rights have been established, and similar bridges will be constructed in the United States and Canada. He plans to work with American consulting engineers on these projects.

"After working with aluminum alloy in primary structures, it was only a matter of time before I began to consider its application to buildings, but I found that economics were not in its favor except in the one field of earthquake design—of particular interest to New Zealand structural engineers."

In buildings exceeding 12 stories, Arnold said the use of aluminum flooring is worth consideration. He currently is designing one of New Zealand's tallest office buildings — 16 stories.

Because prestressed concrete requires a minimum of imported materials, making it a logical type of construction for New Zealand, Arnold also has investigated new uses of prestressed concrete. He has devised a new method of introducing pozzolan into concrete. Raw pozzolan is fed into twin slurring vessels until a standard density slurry is produced. This is pumped into the main mixing vessel as a combination of water and pozzolan. This procedure gives the desired characteristics to the concrete and gives a much better result than the addition of pozzolan as a dry powder.

"Phenomenal results have been achieved using concrete of this nature in sewers subjected to sulphide and sulphate attack."

New Zealand's Youngest

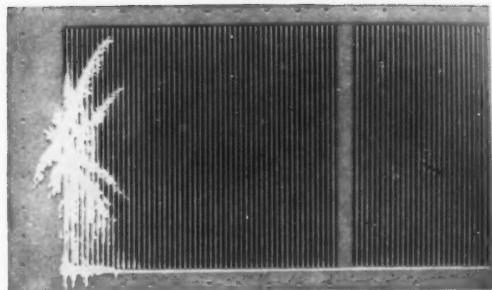
Arnold began his career at 16 as an engineering cadet for the Auckland Harbour Board under the tutelage of the superintendent of the board. He attended Auckland University College at night. He then served for three years with the New Zealand territorial engineers until World War II, when he was transferred to the Royal New Zealand artillery. During the last stages of the war, he helped supervise major construction at the Devonport naval base.

After demobilization, Arnold returned to the Auckland Harbour Board and completed the final examination of the Institution for registration.

For the next three years, he worked in a number of departments of the Minister of Works, gaining experience in all phases of civil engineering.

After his marriage in 1948, he worked on road and bridge construction in New South Wales, Australia. Later he returned to New Zealand representing a British firm in the development of advanced techniques in prestressed concrete, foamed concrete, and foundation grouting. In 1951, at the age of 30, he began his private practice. □□

Will it freeze?

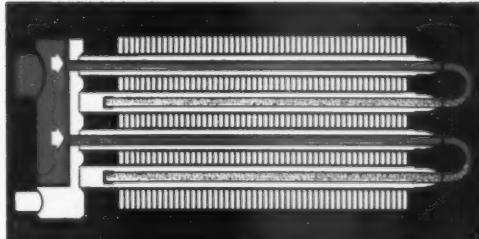


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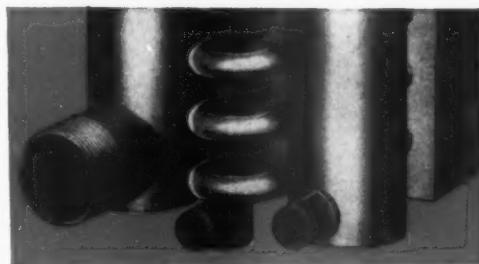
For full details of this exclusive surface, ask for Publication 305



Each trombone steam-distributing tube serves two adjacent condensing tubes from a single supply-header connection. Steam must travel across the first leg of the trombone tube (full length of surface) before reversing, under demand, to serve the second leg. Results: uniform discharge temperatures, controllability, and freeze protection under all modulation.

Series T Heating Surface with Trombone Steam-Distributing Tubes

The story of Water Surface is told in Publication 246

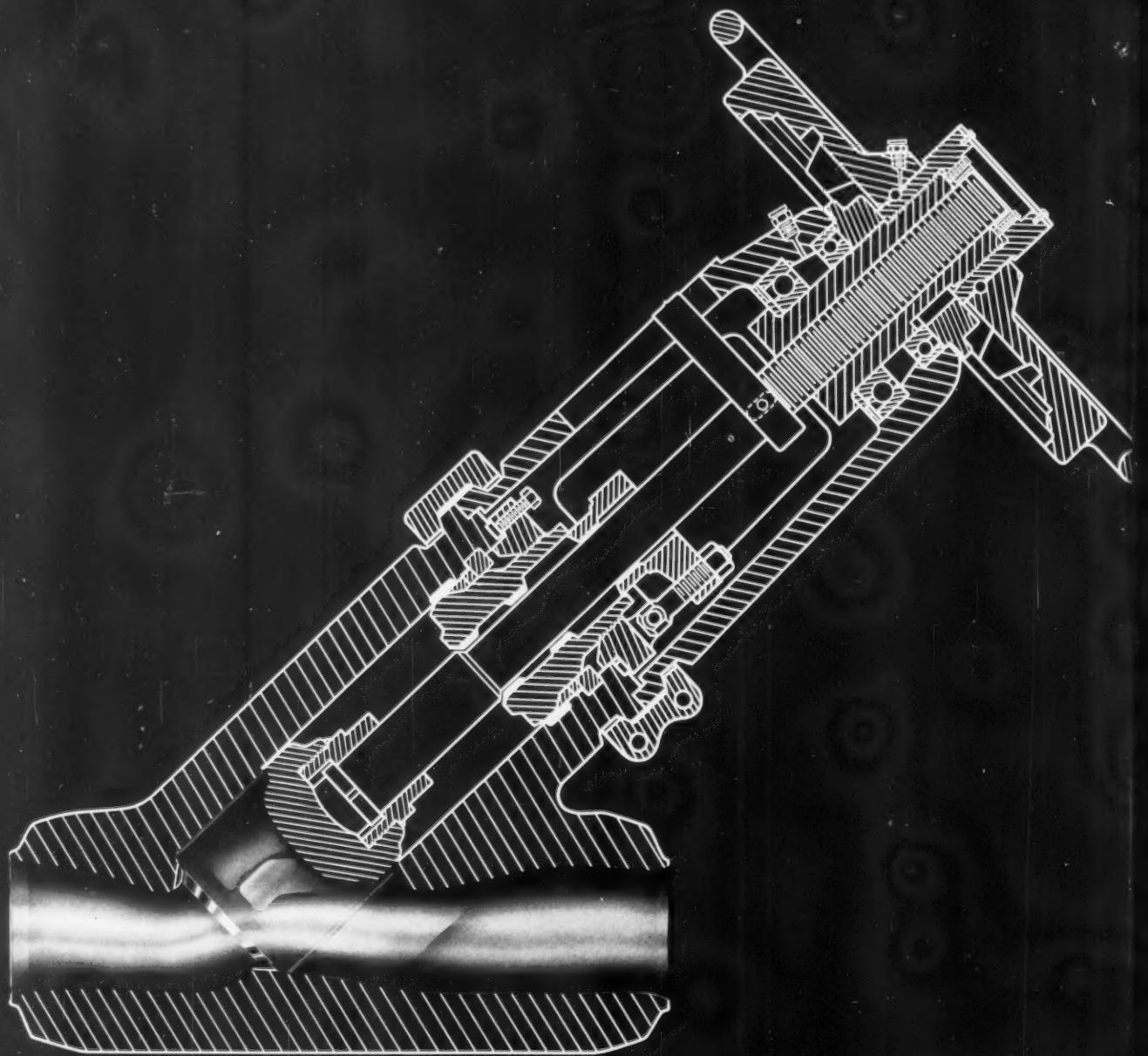


To overcome the difficulty of water-draining in continuous-tube cooling surface, Nesbitt pitches its Series W Surface within the casing and incorporates its exclusive drain headers to relieve trapped bends. The drain feature is also embodied in cleanable-tube surface. No premium is charged for this safety precaution which can save you many dollars of grief.

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*T. M. Reg. U. S. Pat. Off.



Reader's Comment

Hits . . .

Sir:

I have noticed the faint praise of CONSULTING ENGINEER by Dr. Rolf Eliassen in the January issue. He says "your magazine is not really very good yet . . ." but he has hopes for it. Having spent more than 10 years evaluating magazines for advertising purposes, I feel this ex-

perience qualifies me to take professional issue with the statement.

I cannot agree with Dr. Eliassen that CONSULTING ENGINEER "is not really very good yet." I think it is superior . . . the best-read magazine available to practicing consulting engineers.

Harry Terry
Consulting Engineer
Trenton, N.J.

SAFETY FIRST
and savings, too!

with INSUL-8-BAR®
SYSTEMS

Mobile Safety Electrification for Cranes,
Monorails, All Moving Machinery.

These are the only enclosed conductor systems that meet all requirements of mobile safety electrification. Standard catalog parts eliminate the need for special engineering. Installation is fast, maintenance easy. Investigate today!

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INSUL-8-CORP,
Dept. B, 1369 Industrial Rd., San Carlos, Calif.

Rush catalog re Insul-8-Bar mobile electrification.

NAME _____

COMPANY _____

ADDRESS _____

flavor and is most refreshing in this day of modern art. I am reminded of the sketches in old editions of Dickens.

Edward H. Harris
Consulting Engineer
New Orleans, La.

• THE DRAWINGS ARE BY THE EMINENT AMERICAN WOODCUT ARTIST PHILIP REED, NOW OUR ART CONSULTANT—ED.

Sir:

Congratulations on the excellent magazine you are publishing for the consulting engineering profession. It fills a great need and the improvement noted over the past few years is amazing. Keep up the progress . . .

Walter S. Gordon
Consulting Electrical Engineer
Tacoma, Wash.

Sir:

Congratulations upon the high level of interest and applicability which you somehow maintain consistently in your magazine.

Plaudits in particular for your article "Plans and Projects to Promote the Profession," in the February 1958 issue. Reprints of this article would be of value, I am sure, to all publicity agencies which service architect-engineer or consulting engineer accounts.

Keep up the good work.

G. L. McQuade
Smith, Hinchman & Grylls
Assoc., Inc.
Detroit, Mich.

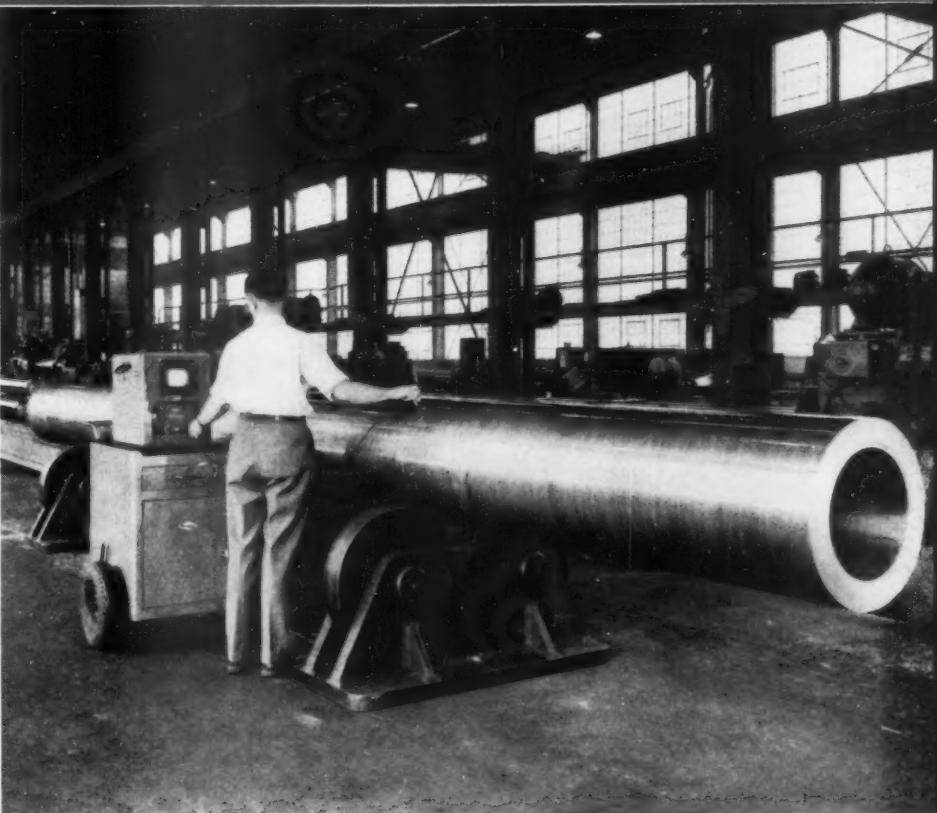
Sir:

On behalf of the Consulting Engineers Association of Oregon let me congratulate you on the personal sketch about Milo S. Ket- chum appearing on the cover of your February issue of CONSULTING ENGINEER. It is very well done and certainly is the most illuminating article on architect-structural engineer relationship I have ever read. I say this not only because that is my field but also because I feel that more should be disclosed.

STEEL FORGINGS by MESTA

custom made
to your
mechanical and
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specifications

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TEES
Y'S
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*Milcor Wall Unit installation in
Prudential Building, Minneapolis, Minn.*

How to limit the cost of concealing convector—without limiting design



Milcor Convector Enclosure Wall Units provide custom appearance with production-line economy

Only your imagination and the requirements of your job limit the way you can use Milcor Convector Enclosure Wall Units.

They are fabricated to individual job details—as (1) enclosures for mechanical heating and air-conditioning equipment; (2) convector enclosures with window jamb and head sections; (3) integrated metal interiors with con-

vector enclosures, window trim, and matching wainscot panels. You can specify width, height, depth . . . gauge of steel (Ti-Co galvanized or cold-rolled) . . . and front-panel construction required for free air circulation and accessibility.

A sales engineer from our nearest branch can help you solve problems in this specialized field. See Sweet's, section 30h/In—or write for catalog 105.

MILCOR® Convector Enclosure Wall Units

It pays...in many ways...to specify Milcor Steel Building Products

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WALL PANELS
Sweet's,
section 3b/In

MILCOR
METAL TRIM
Sweet's,
section 12b/In

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MILWAUKEE • MINNEAPOLIS • NEW ORLEANS • NEW YORK • ST. LOUIS. MT-1

about this subject than has been in the past.

May your ability to channelize tough problems grow in results.

Rowland S. Rose, Sec.
Consulting Engineers Association
of Oregon
Portland, Ore.

... and Errors

Sir:

In the February issue of the magazine CONSULTING ENGINEER there is an article entitled "Report from Canada," which is based on an interview with the writer. At the top of page 122 the article states: "And when Quebec adopted the fee schedule, Ross was chairman of the Consulting Practices Committee for the Professional Engineers group in Quebec." The last word, of course, should be "Ontario." The final draft of this article was checked by telephone and we evidently missed this particular word.

On page 117 the word "Corporation" is used in two instances but it is very evident from the context that this refers to "Associations" or the "Corporation."

John H. Ross, P.Eng.
John H. Ross and Associates, Ltd.
Toronto, Ontario

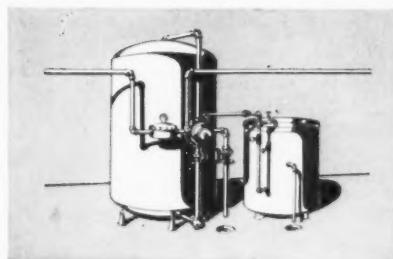
Sir:

Quite a number of brokers, agents, and assureds have called our attention to the article captioned "Errors and Omissions," in the September 1957 issue of CONSULTING ENGINEER. Amongst other things, this article states that since the Continental Casualty is willing to write this type of coverage, Lloyds' cannot legally do so.

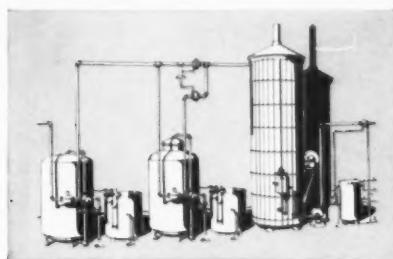
We wish to call your attention to the fact that this is not an accurate statement. We have not made an analysis of the laws of each and every state but we can speak for the West Coast and the laws in the West Coast States, including Oregon, Washington, California, Utah, Idaho, Arizona, and Montana, permit Lloyds' to continue to write this class of business. The law in these

Quote and Unquote:-

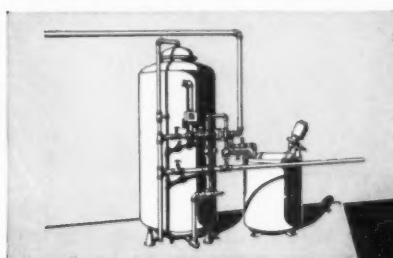
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into ION EXCHANGE
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other firm"**



SOFTENING BY ION EXCHANGE — used to eliminate calcium and magnesium hardness from water. All types of ion exchangers available to meet specific conditions.



DEALKALIZATION BY ION EXCHANGE — produces soft water of controlled alkalinity. Various exchangers used, depending on requirements.



DEIONIZATION BY ION EXCHANGE — produces water of better than distilled quality. Ion exchangers of mixed-bed or multi-column design give "tailor-made" effluent to meet process or boiler plant requirements.



An engineer said this when he was asked why he had brought his not-too-simple water conditioning problem to the Elgin organization.

The particular way he put it set us to wondering how many men with water conditioning problems realize the great strides that have been made in ion exchange . . . how many recognize the vital importance of dealing with a firm that has played a leading role in ion exchange development and application.

It is always bad taste—often bad business—to boast; so we won't say that Elgin has dug deeper than *any* other organization. We simply say that certainly no firm has dug *deeper* into ion exchange application than has Elgin during nearly a half century of specialization.

It is squarely on the record that across the years we have *been a part* of the transition from the first simple greensand through the highly specialized ion exchangers and methods that are today accomplishing little short of water conditioning miracles. Just three of almost countless examples of this are given at the left.

Yes, today it can be said that there is a way to "make over" *any* water supply—*your* water supply—to exactly the kind and quality needed for *any* use. When you put your problem up to Elgin you are certain that Elgin "deep digging" will not only assure you the *right* way, but, still more important, the most *economical* way.

Never forget that Elgin works with *all* methods. No bias; no single-track thinking. One of our engineers will be glad to study your conditions and give you a demonstration of Elgin deep digging.

ELGIN
WATER CONDITIONING
SINCE 1908

ELGIN SOFTENER CORPORATION

146 N. Grove Avenue, Elgin, Illinois

Representatives in Principal Cities

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SOFTENERS



ION EXCHANGERS



FILTERS



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DEAERATING HEATERS

this is the shape of progress in centrifugal fans



The Shape of Progress is—AIRFOIL!

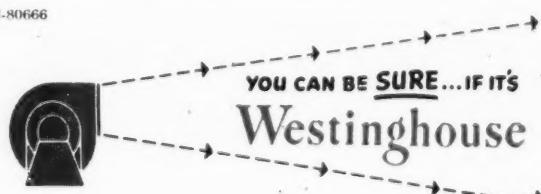
Only Westinghouse offers you the effectiveness and quietness of Airfoil Blading in a complete line of centrifugal fans sized to AMCA (NAFM) Standards.

Westinghouse offers these *bonus benefits* in capacities up to 700,000 cfm and four AMCA pressure classes up to 16 $\frac{3}{4}$ " pressure:

- Lowest Operating Cost
- Quiet Operation
- Capacity Protection
- Non-Overloading Power Feature

To take advantage of this *exclusive offering*, call your nearest Sturtevant Division Sales Engineer, or write Westinghouse Electric Corporation, Department D-1, Hyde Park, Boston 36, Massachusetts.

J-80666



CONSULTING ENGINEER

states does not say that if a licensed company will write the coverage, an unlicensed company cannot do so. What it does say is that Lloyds' cannot write coverage if the majority of admitted carriers licensed to write a class of business are willing to do so.

The situation in connection with engineers' errors and omissions insurance is that there are one or two licensed companies who are willing to write this type of coverage and, of course, this is only an insignificant minority rather than a majority of licensed companies.

J. C. Field, Vice Pres.
Philip Antrobus, Inc.
San Francisco, Calif.

Sir:

In your February 1958 issue you have a story describing some changes which the City of New York expects to take in connection with the issuance of certificates of occupancy.

On page 50, this paragraph appears: "Steps also are being taken to eliminate inspections by the Fire Department and Department of Air Pollution Control."

The first statement is correct, but the report of the City Administrator dated September 1957 entitled "The Fuel Oil Burner Problem," does not contemplate any immediate change in the plan examination or installation inspection procedures in the Department of Air Pollution Control.

Sylvan L. Hamner,
Deputy Commissioner
Department of
Air Pollution Control
New York, N. Y.

Never a Kickback

Sir:

I hate to sound ostentatious or puritanical but cannot help but comment on the article in your December issue by Mr. Anonymous (I Gave Up Ethics to Eat).

For what it is worth, I used to be in the consulting engineering work before I came East and be-

ARROW HART

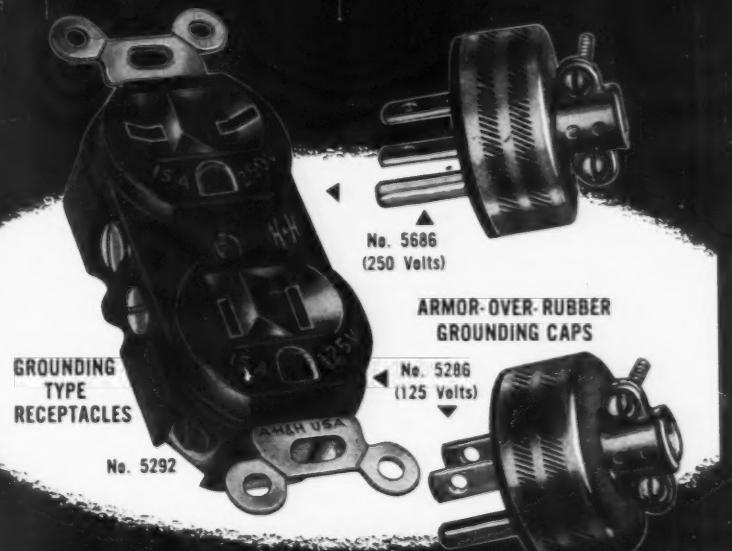
Do Your Plans include "grounding for safety ?"

Mr. Consulting Engineer: There will be portable electrical equipment used in every building — plant, office, school, hospital, etc. — you help plan. Protect this valuable equipment, and those who install, maintain and operate it, by specifying Arrow-Hart H&H specification grade receptacles, connectors and caps that assure proper grounding at all times.

We offer a free 12-page booklet which interprets the National Electrical Code requirements for grounding electricity for portable tools and equipment. Here is everything you need . . . technical information, pictures, diagrams, ratings, and catalog numbers . . . to simplify your specifying job.

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STANDARD PUMPS — A large selection for hydraulic or processing equipment . . . pressure lubrication . . . fuel transfer . . . or you name it! Including all categories, you choose pumps in capacities from 5 to 300 GPM — pressures to 1000 PSI.

SPECIAL PUMPS — Many customers have effected great savings by having Roper modify a standard pump into a Roper "special" pump. A thorough analysis of your specifications will tell whether this is the practical approach to your requirements.

CUSTOM PUMPS — In these units, Roper employs the basic, tested principle of two equal size gears running in a precision fitted case. When the job is so complex only a custom pump will do, then depend on Roper to help you achieve the results you want.

NOT GOING? SEND FOR CATALOG!

ROPER HYDRAULICS, INC.
334 Blackhawk Park Ave.
Rockford, Illinois

ROPER
ROTARY PUMPS

came an editor. During that time I solicited my share of business over a wide range of cities. Never once was I approached for anything resembling a "kickback," and never once was the subject even hinted at. A good deal of my work took place in the grim 1930s when the woods were full of consulting engineers and all of them hungry.

I certainly agree that if the word once gets out that an engineer is good for a kickback, he is sunk permanently with such a policy.

William S. Foster, Editor
American City Magazine
New York, N. Y.

Poor Catalogs

Sir:

Your article on good catalogs in the January issue was interesting.

Several years ago I was employed by a manufacturer to develop a copper radiator. After the development was completed, I supervised the manufacture, then wrote a catalog including technical data, drawings, installation instructions, and a cover design. Nothing superfluous was added, nothing required was omitted.

Since entering the consulting field, however, I have become quite disgusted with catalogs in general and refuse to specify products that are lacking in technical data and ratings, and are hard to understand.

If the manufacturer, who has the intelligence to design and construct a good product, realized the influence of the consulting engineer, he would gladly listen to his suggestions and thereby greatly benefit in increased business.

Frank C. Reynolds
Consulting Engineer
New York, N. Y.

Atomic Bombshell!

Sir:

An interesting Atoms in Action project is under design here in Florida to exterminate the screw-worm. The screwworm is a fly which has been disease cattle by laying eggs in the cuts and wounds

BRUNER INDUSTRIAL WATER SOFTENERS



FAMOUS-BARR BUILDING A in Northland Shopping Center, at Jennings, near St. Louis, Mo.
 Consulting Engineers: Ferris & Hamig, St. Louis, Mo.
 Architect: Russell, Mulfardt, Schwarz & Van Hoefen, St. Louis, Mo.
 Consultants: Marx, Flint & Schonne, Chicago, Ill.
 Plumbing Contractor: Thomas J. Sheehan Co., St. Louis, Mo.

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Automatic
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COMMUNITY HOSPITAL, Indianapolis, Ind.
 Engineer: J. M. Rotz Engineering Co., Indianapolis, Ind.
 Architect: Daggett, Naegle, Daggett, Inc., Indianapolis, Ind.
 Plumbing Jobber: Crane Co., Indianapolis, Ind.
 Plumbing Contractor: Freyn Bros., Indianapolis, Ind.



PANTEX ORDNANCE PLANT, St. Francis, Tex.
 Engineer & Contractor: Silas Mason Co., Amarillo, Tex.

Bruner Industrial Water Softeners are meeting the needs of these important installations and in many other public and private buildings in all 48 states and seven foreign countries. They range from small laundries, schools, motels and resorts to huge hospitals, hotels, factories and atomic energy plants. Bruner is proud of its customer service — famous for product performance.

Bruner softeners, filters and other water conditioning components are available from stock in many types and sizes. Custom installations are fabricated to exact specifications.

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Manufacturer's most famous line of quality water softeners and water treatment equipment.

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You get longer machinery life,
lower maintenance costs with

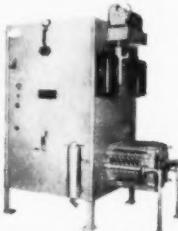
HILCO

OIL MAINTENANCE EQUIPMENT



OIL RECLAIMER

For continuous oil purification in range of 2-100 gph. Removes all solids, acids and volatile contaminants.



PURIFIER-RE-REFINER

For all purification in batches of from 6 to 100 gallons. Removes all solids, acids and volatile contaminants.



HIGH CAPACITY RECLAIMER

Combines filtration for removal of solids and sludge with vacuum vaporization for removal of solids, acids, water, solvents, fuel dilution. Furnished in standard or custom built models to 600 gph.



FILTER

Furnished in capacities from 0.1 to 750 gpm. Various cartridges available for mineral and inhibited detergent oils.

* A COMPLETE LINE OF EQUIPMENT FOR RECLAMING, FILTERING, PURIFYING AND RE-REFINING OIL FROM . . .

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- Steam Engines
- Air Compressors
- Vacuum Pumps
- Transformers
- Circuit Breakers
- Wire Drawing Machines
- Hydraulic Equipment
- Metal Rolling Mills
- Paper Making Machinery



of the animals. The eggs hatch into larvae that feed on the flesh of the animal and, if untreated, eventually will kill it. Losses in livestock in the Southeast have been estimated at over \$20 million per year.

Eradication of the fly will be through the method of exposing the pupae to Cobalt 60, thereby sterilizing the males. Female screwworm flies can mate only one time.

The project under design will produce 50-million sterile flies a week which will be distributed over Florida and southern Georgia. It is believed that by breeding with the sterile male the fly will exterminate itself after several years.

This program is a joint effort of the Florida Livestock Board and the U.S. Department of Agriculture. The laboratory to produce and irradiate the screwworm fly is being designed into an existing airplane hanger at Sebring, Fla. Heim & Heim are the architects and his firm is the consulting engineers.

James A. Hargan
Chas. T. Healy Co.
Tampa, Fla.

• THIS APPROACH ALSO WILL ERADICATE THE KIWEWEE BIRD!

Southern Hospitality

Sir:

"Heard Around Headquarters" in your February issue says southern delegates of CEC are getting their revenge for being forced to stay in the Abraham Lincoln hotel in Springfield, since the executive committee was later lodged in the Roosevelt hotel in New Orleans.

Having just returned from New Orleans, I can report that we were reliably informed that the Roosevelt hotel was named after Teddy and not F.D.R. How do you explain that?

L. K. Crawford
Crawford, Murphy & Tilly
Springfield, Ill.

• UNTIL THE MID '30S THE NAME OF THE HOTEL WAS PRONOUNCED "RUE-SEVELT." SINCE THAT TIME IT HAS BEEN "ROSE-EVELT." HOW DO YOU EXPLAIN THAT? □



It takes just two steps to assemble the FLUID-TITE Coupling. Lubricate the tapered edge of the gasket. Then slide in the pipe.

Major Advance In Waterworks Industry. K&M's exclusive FLUID-TITE Coupling provides permanent, water-tight, root-tight connections. Allows deflection of up to 5°. Assembled in any weather.

SLIDE IT IN QUICK... IN 2 EASY STEPS

IT'S "K&M" ASBESTOS-CEMENT PRESSURE PIPE WITH EASY-TO-INSTALL FLUID-TITE COUPLING

Installation is fast and economical! It doesn't require skilled labor, heavy machinery, or heavyweight coupling pullers. Install it in any weather.

The seal grows tighter as the pressure climbs! Coupling rings expand as water mains fill. Rings have holes on one side for self-energizing action.

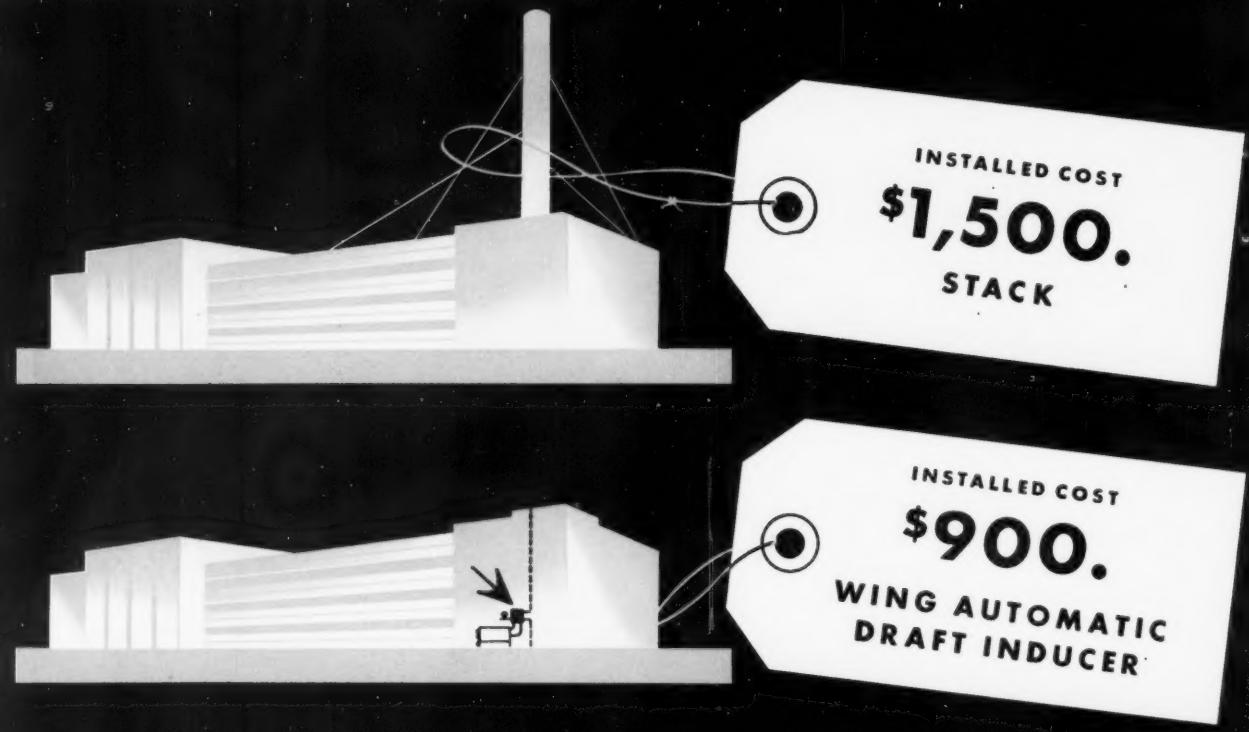
It's practically indestructible! "K&M" Asbestos-Cement Pressure Pipe is non-tuberculating, non-electrolytic, and corrosion-resistant. Its first cost

is often the last cost. Pressure remains normal—pumping costs stay low.

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Wing

DRAFT INDUCERS Cost Less Cut Fuel Bills

Lower "installed cost" is the first advantage of Wing Draft Inducers. The figures shown above, taken from an actual installation, show how savings of over 25% are possible.

This is one reason expensive, ugly smokestacks have disappeared from today's modern, low buildings. Owners of older buildings, too, find that Wing Draft Inducers are less expensive than replacing tall smokestacks which have corroded or are in danger of falling.

In addition to lower "installed costs," Wing Draft Inducers also cut fuel costs by as much as 15%. These savings are the result of consistent, proper draft for complete fuel combustion. With Wing Draft Inducers you are not at the mercy of the weather for proper draft and complete combustion.

Another advantage is negligible maintenance. There's no tall stack to repaint every two or three years, no brickwork to point up or replace. Wing's design and construction, shown on the next page, have given years of reliable operation in thousands of installations.

For detailed information on how Wing Draft Inducers can give you Lower Installed Costs, Lower Fuel Costs and Reliable Operation, write for Bulletin 157.

OTHER WING PRODUCTS: Unit Heaters, Fresh Air Supply Heaters, Fans, Turbine and Motor Blowers, Auxiliary Turbines.

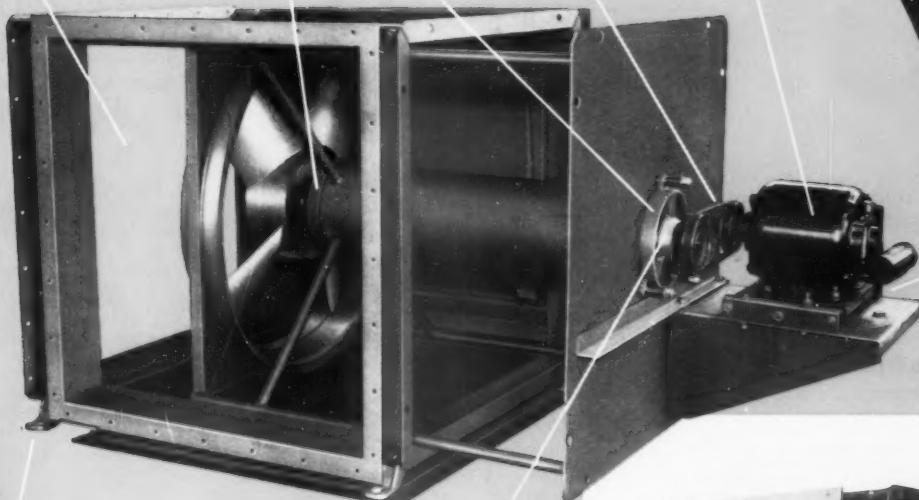
Entire fan and bearing assembly easily withdrawn from casing. All parts are then accessible outside the stream of hot gases.

Interchangeable Inlet Panels provide flexibility of installation. Assure most efficient use of boiler room space.

V-belt drive eliminates need for field alignment.

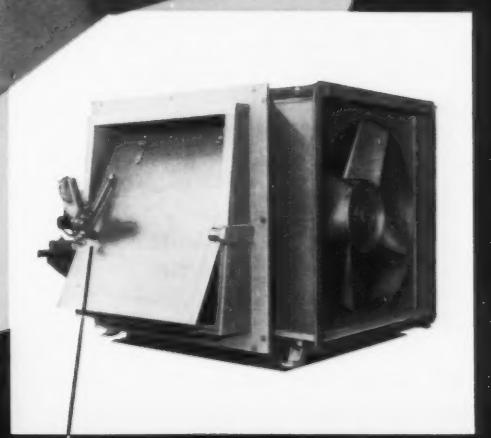
Precise draft control assured through variable speed motors.

Belt tension automatically maintained by special spring-base mounting. No field adjustments necessary.



Mounting can be for either horizontal or vertical discharge by positioning four mounting feet.

No lubrication needed. Exclusive air cooling system keeps sealed bearings within few degrees of ambient.



Built-In Barometric Damper is optional.

For use with oil, gas, stoker or hand-fired heating boilers, industrial furnaces, kilns or high pressure steam boilers.

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DIVISION OF AERO SUPPLY MFG. CO., INC.

140 VREELAND MILLS ROAD, LINDEN, NEW JERSEY
FACTORIES: LINDEN, N.J. AND MONTREAL, CANADA
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ADVANCE®



Industrial
Power Plant
Projects

The Reader's Guide

There is another series of Special Project Reports in this issue. This one deals with Industrial Power Plants — power plants designed to provide heating and process steam and electric power for an industry. There are not as many industrial plants generating their own power as there once were in this country. In the early days of the century, almost every mill or factory of any size had its own boilers and its own turbines or steam engines. But as greater efficiencies were achieved in the central station plants of the public utilities through the use of higher temperatures and pressures and better auxiliary equipment, it generally became more economical to purchase power rather than generate it. But in some industries, the requirements for steam fit so nicely with power demands, that it is possible to effect large savings through the generation of power as a by-product, and over the years the installed capacity of industrial power plants actually has increased despite the reduction in the number of plants. We were fortunate to be able to get Mr. Alf Kolffat, of Sargent & Lundy, to write the introduction to this special section. In his article he explains the general conditions under which industrial power generation is profitable. The special section on "Industrial Power Generation" starts with a natural color photograph of the Argo Plant of Corn Products Refining Company — page 107.

This issue brings you another important First for CONSULTING ENGINEER. You will find a special fold-out on page 125. It will tell you about the weather in the month ahead. This is not one of those general, long range forecasts. Here is detailed information on your own area. On the first spread of the fold-out you will find an over-all prediction of weather conditions for April, followed by an estimate of construction days for every section of the country. There are also charts for May and June that show historical averages for construction days for each part of the country. Then, on the reverse of the fold-out there is more vital weather data. For every section there is a double bar chart showing April periods of precipitation and periods of warm or cold. By the application of this information, you not only will be able to tell how many days during April the contractors will be able to work, but you can foretell which days will be working days. You can intelligently plan your inspection trips to distant projects, and you will be able to tell whether it is likely that the contractor will be ahead or behind schedule at any time of the month. We get this information from Dr. Irving P. Krick, of Denver. He is a private weather consultant. He makes use of a UNIVAC and some formulas of his own to forecast weather on a long range basis. He is not always right, but he has a remarkably good record — better than the Weather Bureau on long range work. His system makes it possible for him to predict for three or six months ahead as accurately as for the day after tomorrow. It will be interesting to check him from month to month to see how well he does. This special weather prediction is prefaced in this issue by a short article explaining Krick's methods. It starts on page 122. We must admit that we are proud of our arrangements with Krick permitting us to provide you with this information each month. Again, this is a CONSULTING ENGINEER *Exclusive*. No other publication has anything like it.

High Frequency
Lighting

The lighting of the gymnasium at the University of New Mexico has received considerable publicity. But none of the articles previously published tell how Carl Albach, the consulting engineer for the project, went about his job of selecting one frequency or one type of equipment over the others. Here is the story from the consulting engineer's point of view. It goes into detail concerning

Krick Predicts
Your Weather

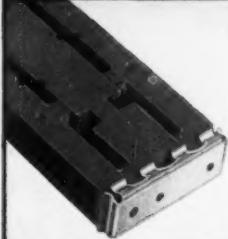
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CAPACITOR



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COILS



ADVAN-guard



1 Constructed of high-grade silicon steel, punched to exacting tolerances and precision assembled. Core and shell are annealed to insure lowest wattage losses.

2 Capacitors for Power Factor correction and phase displacement are of highest quality construction. Rigid inspection and factory testing assure uninterrupted, dependable service.

3 Built-in filter corrects line feed back to the radio from the lamp through the power line and prevents direct radiation from the electric supply line to the aerial circuit.

4 Coils are firmly wound and are of identical size, shape, weight and operating characteristics. The complete assembly is vacuum impregnated with a thermal setting phenolic varnish.

5 A thermally actuated protective device that prevents ballast operation at abnormal temperatures thus increasing fluorescent lamp ballast life. Advanguard optional at additional cost.

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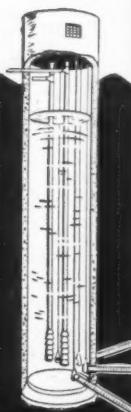


TRANSFORMER CO.

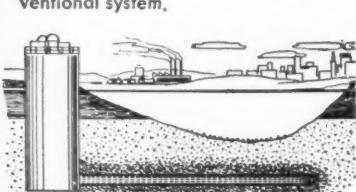
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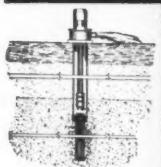
RANNEY



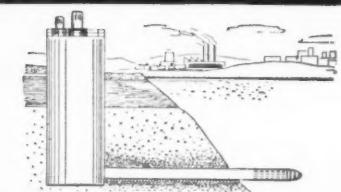
CONVENTIONAL COLLECTOR



INFILTRATION GALLERY



RANNEY VERTUBE



RANNEY INTAKE

A Few Industries Using Ranney

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Cities
Anderson, Ind.
Boise, Idaho
Canton, O.
Grand Haven, Mich.
Jacksonville, Ill.
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THE RANNEY INFILTRATION GALLERY provides low cost water supply to industry and community. The gallery provides large quantities of clear non-turbid water in a revolutionary yet economical way, and it requires no maintenance.

RANNEY VERTUBE. A natural gravel vertical water well at low cost, developed exclusively for low volume users. Engineered with the same precision and efficiency that has made Ranney a must for communities.

THE RANNEY INTAKE designed to provide surface water efficiently and economically. These structures can usually fit into the design of your engineering department or consultant.

RANNEY
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Dept. CO-2



his preliminary studies and his reasons for making his decisions. "My Approach to High Frequency Lighting" starts on page 96.

The Vanishing Slide Rule

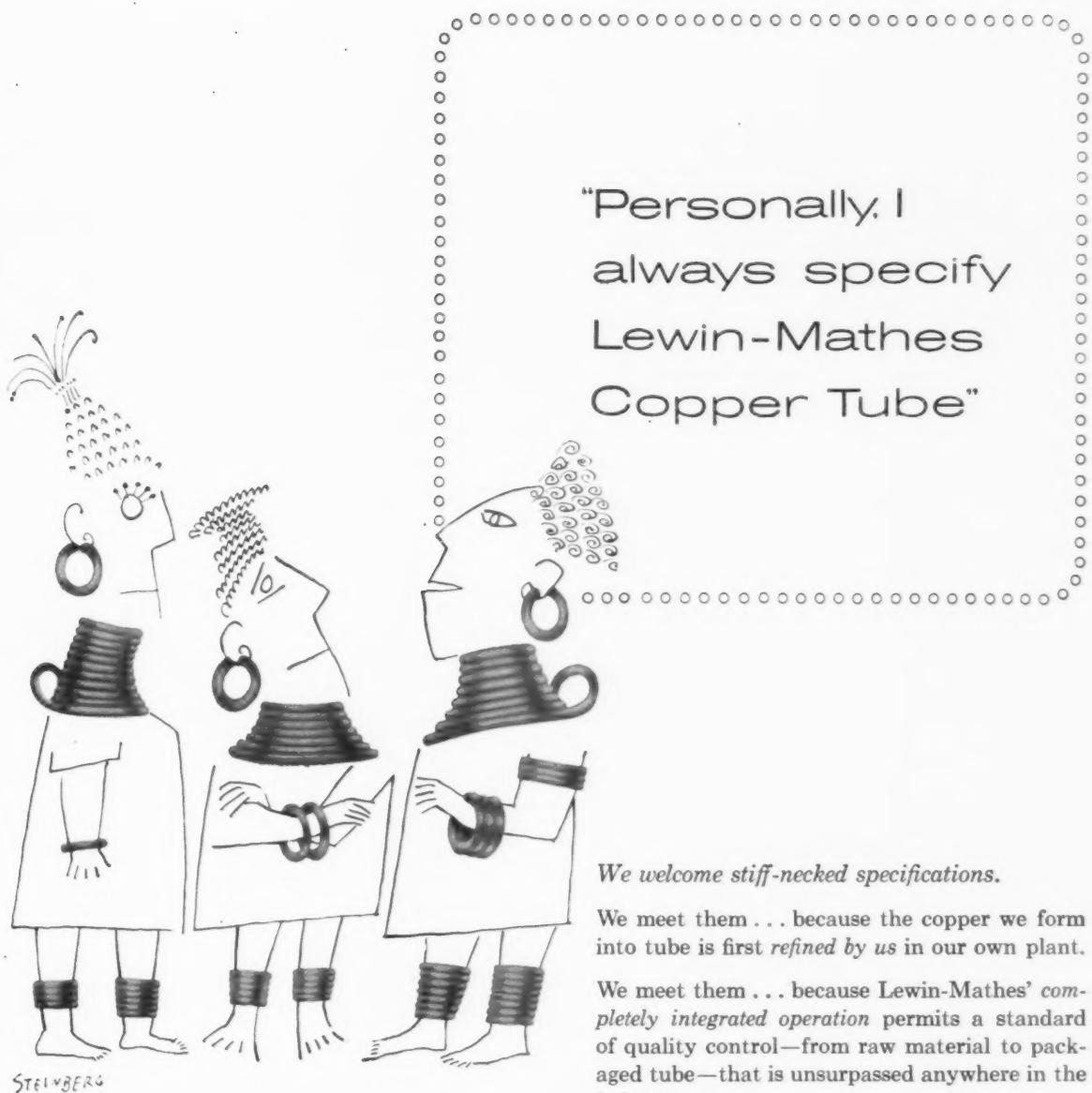
The slide rule as a symbol for the engineer may be on its way out. The Log Log Deci Trig Duplex (or are there yet more complicated ones today) is a child's abacus, a poor thing indeed, when one is faced with some of the more difficult problems involved in modern highway and bridge engineering. That type of problem takes an electronic computer. The firm of Michael Baker, Jr., Inc., which may be the largest firm of independent consulting engineers in the world (over 1200 employees), has just installed its own computer center. While this is an undertaking of some magnitude, the setting up of a computer center is certainly not limited to the very largest firms. Relatively small firms may find that they can make use of computers frequently enough to be able to afford the rental — especially if they take on computing work for other firms for a fee. See "Setting Up a Computing Center," by Edgar C. Richardson, starting on page 102.

"Where's that Drawing?"

"How B & V Handle Drawings and Reports," by A. V. Ferry, of Black & Veatch, Kansas City, explains that firm's system for reproduction and filing of reports, specifications, and drawings. It is a simple system, but it is efficient and straight to the point. Only fairly good size firms can afford to own their printing and binding equipment — particularly equipment that will do color printing for maps and graphs, but even the smallest firms can make use of a filing system of the type used by Black & Veatch. Metal shelves and bins are not expensive, and it is only good sense to keep these valuable records in a fireproof vault. This information is presented mostly in pictures. The article starts on page 88.

CD Goes Underground

Unusual structures demand original solutions to the engineering problems involved. Just such a structure recently was designed for Portland, Oregon. This is a civil defense center, built in the side of a hill. Naturally, this involved a number of structural, mechanical, and electrical solutions quite unlike those required for a normal sort of building set on a conventional site, above ground. While few cities have yet felt the need for underground civil defense centers, and while we hope the demand for buildings for this purpose will not increase, here is a simple design for an underground structure that has proven itself in service. The article is "Designing an Underground Building," on page 92.



"Personally, I
always specify
Lewin-Mathes
Copper Tube"

We welcome stiff-necked specifications.

We meet them . . . because the copper we form into tube is first *refined by us* in our own plant.

We meet them . . . because Lewin-Mathes' *completely integrated operation* permits a standard of quality control—from raw material to packaged tube—that is unsurpassed anywhere in the industry.

As refiners, we know the copper going into Lewin-Mathes Tube is pure. As fabricators, we painstakingly control every physical and chemical property of the finished product. And as *integrated specialists*, we take pride in delivering every foot of Lewin-Mathes Copper Tube uniform and perfect . . . to meet your most exacting requirements.

Nothing primitive about Lewin-Mathes supply facilities.
Our products are available through Wholesale Distributors,
serviced by Lewin-Mathes Mill Depots throughout 48 states.

LEWIN MATHES
SAINT LOUIS, MISSOURI
COPPER AND BRASS TUBE, PIPE AND ROD
DIVISION OF CERRO DE PASCO CORP.

Mr. Smith is 600 duct feet farther from



the fan room than Mr. Jones, yet . . .

both men work comfortably at the same temperature!

*when ducts are fitted square and tight with
Johns-Manville semi-rigid Spintex Insulation*

SEMI-RIGID SPINTEX® works two ways to lessen heat loss, stop condensation: first, with low conductivity . . . then, with its square, tight fit. The structural strength of this material, which is fastened snugly to duct surfaces with pins and clips, prevents "ballooning" due to duct leakage. And butted or mitred joints eliminate stretching and thinning of the insulation at corners. Instead, there's a full thickness of Spintex—with full protection against heat loss and condensation—over the entire duct area.

This two-way "edge" in insulating effectiveness is the big reason why leading engineers everywhere specify semi-rigid Spintex . . . for factories, institutions and office buildings of every description.

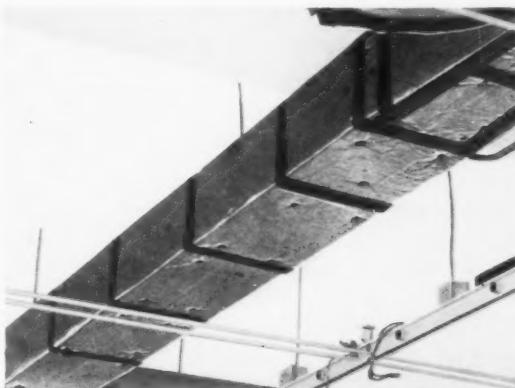
LESS HEAT LOSS...NO CONDENSATION AT CORNERS!
Semi-rigid (not flexible) Spintex fits squarely and tightly all duct surfaces. Stretching and thinning at corners, unavoidable with wrap-around insulations, are eliminated completely. Instead, Spintex retains full thickness everywhere to stop heat loss and condensation. Its structural strength prevents "ballooning."

FACED FOR ANY SPECIALIZED NEED!
J-M offers you a facing to meet any vapor condition, incombustibility requirement or decorative need. Provides good base for plaster finish . . . or where no facing is indicated, Spintex presents an attractive appearance with trim, tidy joints.

INSTALLS QUICKLY . . . ECONOMICALLY.
Spintex is clean, sanitary and "friendly" to handle. It cuts readily with an ordinary knife. Installs quickly, easily, even when ducts are curved or in difficult-to-reach areas.

Produced by a new Johns-Manville spinning process, today's Spintex offers more insulating value than ever. Its mineral fibers are smaller in diameter, and substantially more uniform. This improved fibrous structure adds countless heat-blocking dead-air spaces per cubic inch to help keep working temperatures precisely the same throughout the structure . . . with minimum operating costs!

Your Johns-Manville sales representative will be pleased to send you information, along with samples of Spintex and J-M facing materials. Why not call him today. Or write Johns-Manville, Box 14, New York 16, N. Y. In Canada, 565 Lakeshore Road East, Port Credit, Ontario.



AIA FILE NO. 37-D-1-2

JOHNS-MANVILLE



Scraps & Shavings

FINAL ARRANGEMENTS now are being made for CONSULTING ENGINEER'S 1958 European Tour. This is, we feel, one of the most important contributions this magazine has made to the profession. The idea originated in 1956, two years ago, when we got together a small group of consulting engineers from this country and took them to meet with consulting engineers in England, The Netherlands, Germany, Switzerland, and France. In each of these countries, the group met at luncheons with the local associations of consulting engineers. Our engineers were invited to visit the offices, projects, and frequently homes of European engineers.

The American group learned a lot about how consulting engineers work in Europe. There is also evidence that European engineers learned something about American practice. This process of learning was not confined to the business and professional aspects of private practice. There was also an exchange of important technical information.

On that trip in 1956, considerable progress was made toward some sort of arrangement that would bring together the organizations of consulting engineers in Europe and the U.S. associations.

From its start, the Consulting Engineers Council has had an interest in possible affiliation with the International Federation of Consulting Engineers (FIDIC). During the past two years the Council has been too busy building itself up domestically to be more than casually concerned with foreign affairs, but now it is coming of age and beginning to show an interest in worldly things. We understand that FIDIC has issued an invitation to the Council to send an observer to their annual meeting in Oslo, the end of May. It is also understood that the Council plans to accept this invitation.

An invitation to send an observer does not mean that the Council will be invited to join FIDIC nor does it mean that the Council would want to join. It merely offers an opportunity for the Americans to look at them and for them to look at us. If both like what they see, this meeting could lead to U.S.

participation in the International Federation.

We hope it works out that way, for since the first exploratory meeting of the ten associations of consulting engineers, in St. Louis, in 1955, this magazine has been constantly encouraging the Council to have a look at FIDIC and encouraging FIDIC to have a look at the growing Council. We think they fit together.

These aspects of association are, however, only a side interest of CONSULTING ENGINEER's Tours. While many American consultants go abroad for business or pleasure each year, only through this Tour is it possible to meet and work with so many professional contemporaries in so many countries.

This year, leaving New York on May 5, a larger group will be taking the Consulting Engineers Tour of Europe. The group will go to London, Brussels (the World's Fair), Berlin, Paris, Milan, and Rome. Some of the group will return to this country from Rome, others will go to Spain and Portugal, at least two plan to go to Russia, and it is likely that one or perhaps two will go to Oslo for the FIDIC Annual Meeting. During the tour, while most will attend the luncheons arranged with each of the associations of consulting engineers, individual arrangements are being made for each engineer or each couple (several wives are going along) to go where they want and do what they like.

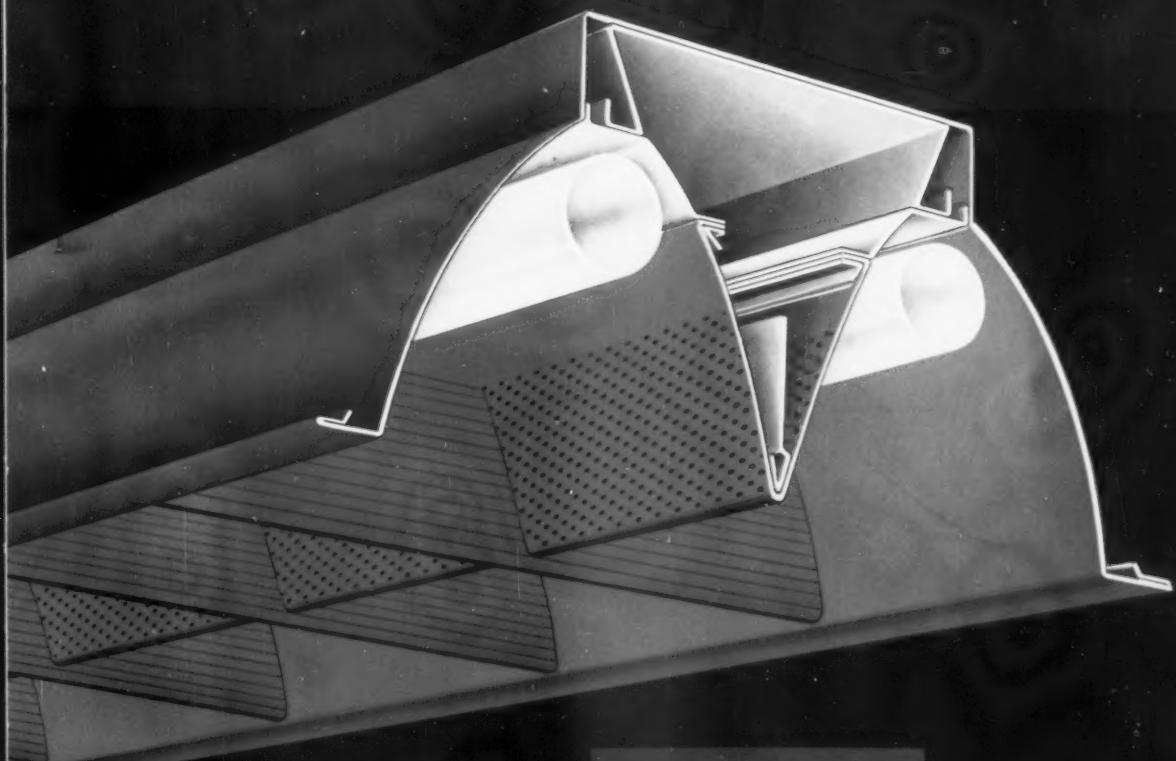
It is good to see that more and more engineers in private practice in this country are recognizing the value of these contacts with engineers from other parts of the world.

There are, however, still many engineers in this country who cannot see any advantage in our going outside our own country for ideas. They still think that Europe is behind us in applied science. They fail to recognize that the majority of the new ideas in structural design have come from abroad and that there are certain aspects of mechanical and electrical engineering in which the best engineering minds of Europe are well ahead of us. We are undoubtedly the leaders of the world in mass production of goods, but we have no monopoly on scientific thought — a point brought out only too clearly in recent months.

This year's tour is being limited to 30 persons. There is still room for two more couples. Any interested engineer in private practice should wire or call the Editorial Offices, Saint Joseph, Mich. □□

Latest Development
in Combined
Lighting and
Air Diffusion

PARAFLO



DECIDEDLY BETTER
DAY-BRITE
Lighting Fixtures

PARAFLO

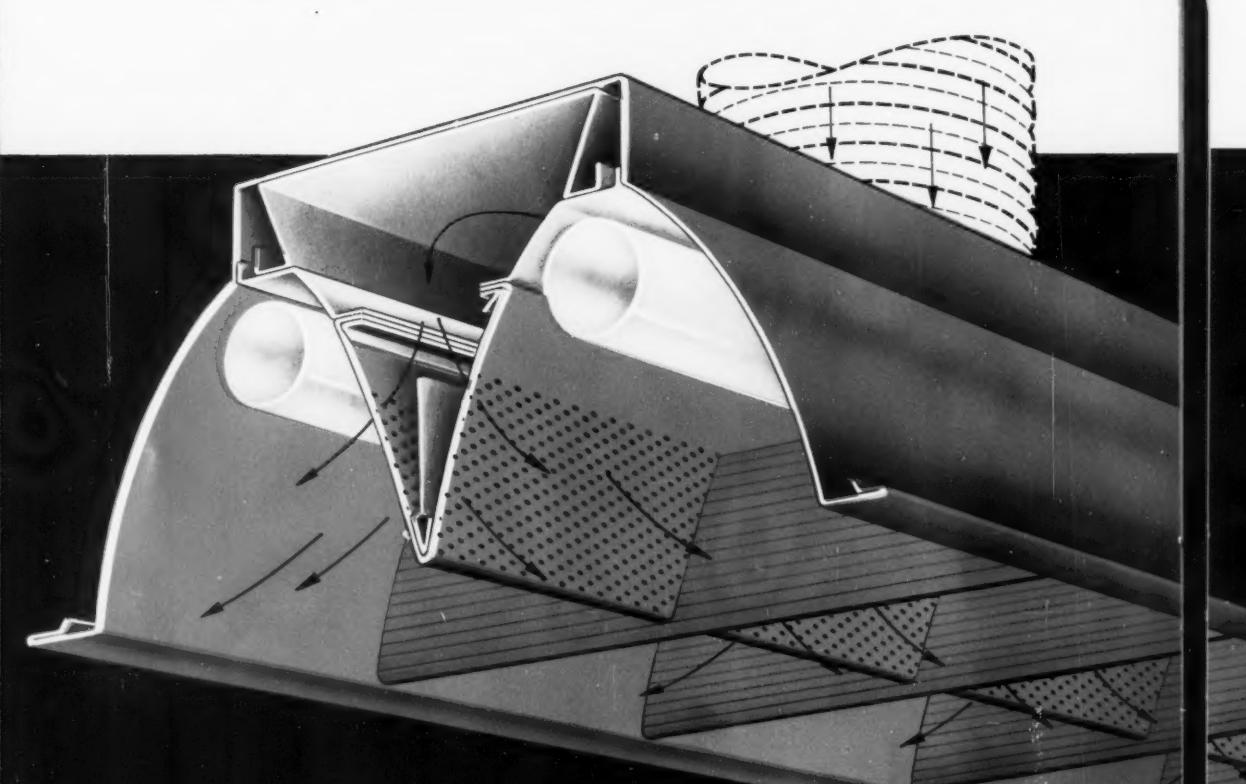
THE TROFFER THAT DELIVERS . . .

COMFORT COOLING in summer

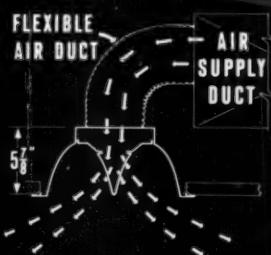
COMFORT HEATING in winter

COMFORT LIGHTING the year 'round

CLEAN . . . UNCLUTTERED CEILINGS . . . combining high comfort illumination and air distribution into one attractive functional unit.



QUIET . . . SMUDGE-FREE AIR DISTRIBUTION . . . PER-AIR-
ATIONS throughout the entire length of Center "V" Louver
diffuse conditioned air gently and evenly. Low pressure drop
assures quiet operation. Controlled lateral deflection of air
stream eliminates waterfall effect without ceiling smudge.
Damper adjustable without removing louvers . . . PARAFLO is
used with special components developed by the Uni-Flo Division
of the Barber-Colman Company.



FLEXIBLE SPACE PLANNING

Here, from the pioneer in the development of the Ceiling Indexing System, is your most versatile choice for applications using movable partitions. Modular PARAFLO can be installed in any suspended ceiling. Compatible with more than 90 different ceiling suspension systems.



SYSTEM "F" Flange troffers for use with acoustical ceilings using Concealed Mechanical Suspension.



SYSTEM "G" Grid troffers for use with acoustical ceilings using Exposed Grid Suspension.

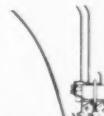


SYSTEM "L" Hook-on troffers for use with acoustical ceilings using Exposed Panel Suspension.

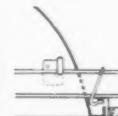
Permits greater freedom in future arrangement of partitions because air flow components can be quickly installed or interchanged... You air-condition as you light-condition for cleaner design, simplified mechanical planning, and easier installation.



SYSTEM "M" Snap-in troffers for use with metal pan acoustical ceilings using "Tee-Bar" Suspension.



SYSTEM "P" Flange troffers for use with plaster ceilings using Concealed Mechanical Suspension.



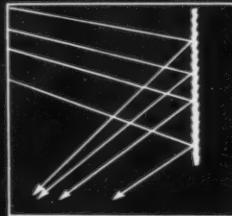
SYSTEM "R" Hook-on troffers for use with acoustical ceilings using Exposed Runner Suspension.

LOW-BRIGHTNESS COMFORT LIGHTING

Adapted from Day-Brite's exclusive Paralouver® Troffer, PARAFLO is shallow and light weight. Patented Paralouvers, combined with parabolic Alzak body and center "V", reduce brightness

in the "glare zone". Available for use with two 4-foot Rapid-Start or two 8-foot Slimline lamps. Choice of diffuse aluminum with Paralouvers, or Super-White Baked Enamel with Paralouvers.

THIS IS HOW THE PARALOUVER WORKS... The light striking the louver is reflected in a controlled downward direction, out of the "glare zone".



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| ARIZONA | GEORGIA | MICHIGAN | JOHN C. RINGLAND | Joe Leve Booker Nashville 4 |
| Wm. Benndorf Co. Phoenix | Ruff & Cannon Atlanta 1 | E. B. Wolf & Assoc. Detroit 1 | Rochester 11 | TEXAS |
| CALIFORNIA | ILLINOIS | W. Dale Crites Haslett | Frank A. Coley Syracuse | H. A. Aucter Dallas 2 |
| Day-Brite Lighting, Inc. Beverly Hills | C. B. Thorsen & Assoc., Inc. Chicago 25 | MINNESOTA | NORTH CAROLINA | N. O. Reed Houston 6 |
| Alan Humphrey Fresno | Dale I. Miller Olympic Fields | Jim Hallek Minneapolis | Gordon Weils Charlotte 2 | Stewart O. Norris Lubbock |
| L. J. Van Nostrand Sacramento 14 | INDIANA | Paul J. Murray St. Paul 5 | OHIO | Richard W. Barnes San Antonio |
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| San Diego 1 | Indianapolis 4 | Day-Brite Lighting, Inc. St. Louis 7 | H. C. King Cincinnati 37 | Jack Lowder Salt Lake City |
| James H. Brundage, Jr. San Francisco 3 | IOWA | E. H. Lauth & Associates, Inc. St. Louis 10 | Judson Lord Columbus 12 | VIRGINIA |
| Day-Bright Lighting, Inc. of Calif. | James H. Hull Des Moines 11 | NEBRASKA | Edward H. Unruh Toledo 12 | Earl Dagenhardt Richmond 25 |
| Santa Clara | KENTUCKY | Carl R. Price Omaha 1 | OKLAHOMA | WASHINGTON |
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| J. A. Reeves Denver | LOUISIANA | NEW MEXICO | OREGON | WISCONSIN |
| CONNECTICUT | Paul Hogan, Jr. New Orleans 12 | Joe E. Pearce Albuquerque | Ray M. Cammisa Portland 8 | Earl H. Aik Milwaukee 8 |
| Frank E. Brown Farmington | MARYLAND | NEW JERSEY | PENNSYLVANIA | Robert M. Aik Neenah |
| FLORIDA | Samuel Masland, Jr. Baltimore 17 | Hauser & Hargis Bloomfield | Hopkin Bros., Inc. Philadelphia 6 | HAWAII |
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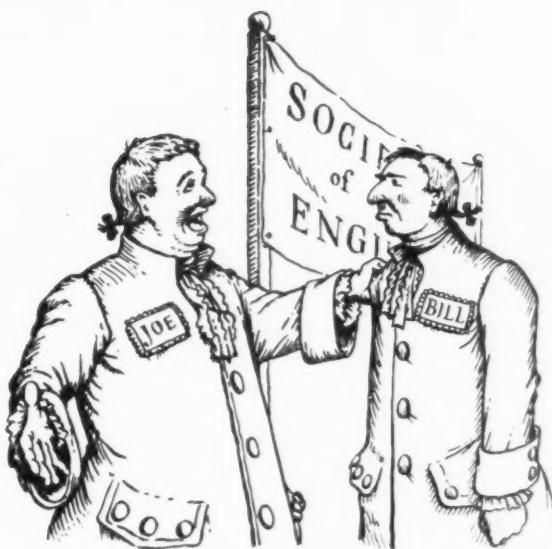
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| E. B. Bomar Phoenix | Barber-Colman Company Indianapolis 2 | R. L. Deppmann Co. Detroit 2, Grand Rapids, Saginaw | OHIO | Gardner-Scott Co. Nashville 4 |
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| G. H. Avery Co. of Ark. Little Rock | INDIANA | Uhl Company, Inc. Minneapolis 2 | Cleveland 3, Youngstown, Akron | Philips-Moore Equip. Co. El Paso |
| CALIFORNIA | Deco Engineering Products | MISSOURI | Richard Equipment Co. Cincinnati 2, Dayton, Columbus | R. H. Wittbold Co. Houston 6 |
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For lighting data, write Day-Brite. For air distribution data, write Barber-Colman Co., Rockford, Ill.



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**NATION'S LARGEST MANUFACTURER
OF COMMERCIAL AND
INDUSTRIAL LIGHTING
EQUIPMENT**



Heard Around Headquarters

STAFF

THE NEW YORK State Society of Professional Engineers has voted to dispense with the services of the Society's executive director for six months, as of March 1 of this year.

The director, Harold Funk, has agreed to work until June 1, however, in compliance with a request from President Franklin J. Johnson. Funk is the sixth executive director NYSSPE has had in the past seven years. Average term of office, prior to Funk, was less than 16 months.

Funk, who was a consulting engineer for 12 years prior to accepting the position with NYSSPE in August, 1954, plans to retire after June 1. He made no pretense of having resigned, an "out" offered him by the board.

"I have made the statement for years, and I make it again now — I would never resign," Funk said.

AIME Annual Convention

The American Institute of Mining, Metallurgical, and Petroleum Engineers had a captive audience of 4000 persons attending the annual convention in New York City this year.

The day the delegates began to gather at the Statler, it started snowing. The storm continued and became a record snow that tied up transportation for several days. However, AIME officials think the weather cost the convention 1000 delegates.

This was the first annual meeting of AIME in which the Society of Mining Engineers (12,000 members), the Metallurgical Society (7000), and the Society of Petroleum Engineers (11,000) participated as constituent societies of AIME.

A symposium of the Metallurgical society education committee proposed 125 industry-financed

scholarships, totalling \$129,000 a year, to stimulate (at the high school level) a larger awareness of the metallurgy and ceramics professions. The funds would be solicited from industry on a \$5000 four-year basis, with a maximum of five scholarships for any one donor.

Among the technical session highlights were . . . Two American scientists, who visited Russia recently, said there is no shortage of money or manpower in the Russian metallurgical research program, but there are signs of a shortage of leaders. This scarcity of talent at the top could have a profound effect on the balance of the research effort although the Russians are confident that the large number of scientists now being trained will solve the problem.

"Immensely complicated boundary problems" were forecast for the oil industry in future offshore developments. James Terry Duce, vice president of the Arabian American Oil Co., said there is almost as much area prospective for oil offshore as on the continents, so the prospecting for minerals in the sea areas has just begun. But "means of developing secure titles must be evolved before the large investments necessary to operate in the sea areas can be attracted," he added.

Ralph O. Rhoades, senior vice president and a director of Gulf Oil Corporation, said the elimination of oil imports to the United States would inflict an incalculable amount of damage on the whole nation for the short-term benefit of a few. He added that today the U. S. reserve, calculated on current consumption rates, would carry us for no more than 11.3 years. This is the lowest point since 1936, the first year for which reserve figures were reported by

the American Petroleum Institute.

H. W. McCobb, vice president and director of Standard-Vacuum Oil Co., agreed. The Middle East, with colossal reserves of oil, has barely begun to tap these resources, whereas the United States is using up its resources at an extremely rapid rate, he said.

"Apart from the fabulous Middle East, Africa seems to be the land of promise, so far as petroleum exploration is concerned," McCobb

said the leading African contender is the Algerian Sahara.

Speaking to the Mining Division, Donald M. Davidson, vice president of E. J. Longyear Co., said the big advance in modern prospecting lies in "the improved techniques and entirely new concepts in aerial geophysical surveys developed since World War II." He added that "modern electromagnetic, magnetic, and radiation surveys from the air have led to the

discovery of new ore bodies in this country and in Canada and account for hundreds of millions of dollars of new mineral reserves that have been brought to light in the past 10 years."

Edward Thomas, roof control project leader of the U. S. Bureau of Mines, had a few words to say at a "Bump Symposium" held at this meeting.

"An analysis of 117 bumps in coal mines shows that 67.6 percent of such occurrences are associated with pillar-line points. Slabbing, splitting pillars, development in abutment zones, and other unfavorable mining practices are indicated as contributory or basic primary causes of bumps.

"Much work remains to be done to make prediction of bumps more certain by tying geological conditions to occurrences; instrumenting pillars for loading; and gathering data on strength of coals, bottom rocks, and roof rocks."

Lofty Ideals

The National Society of Professional Engineers, at its spring meeting in Lansing, urged the creation of a "Federal Space Exploration Commission," with full power and resources to undertake long-range space programs.

The NSPE board pointed out that "the crucial need of the hour is for the sort of dynamic leadership that will bring about full-scale participation in the responsibilities and benefits of the exploration of space by American industry, by the entire scientific, engineering, military, and educational communities, and by as broad a segment of the general public as possible."

EJC Incorporation

Incorporation of Engineers Joint Council currently is being delayed by one case of pleurisy and one of pneumonia.

Referred to New York State's three-man board of standards and appeals, the incorporation must be approved by a majority of the

HAWS

← ONE - PIECE → FIBERGLASS UNIT

with squared ends for
flush mounting in
continuous counters



DRINKING FOUNTAINS



PANTRY FAUCETS



LABORATORY FAUCETS

For commercial, school, industrial and residential use...
HAWS Series 2800 is a one-piece fiberglass molded unit with integral receptor and deck-top. No cracks or joints for water accumulation. It's specifically designed for simple installation in continuous counters; squared ends butt snugly against adjacent counters. Decks slope to receptor for complete, unhindered drainage.

Fiberglass finish is colorful and durable! You can choose from five decorator colors at no extra cost! Choose your pantry faucet and fountain fixtures, too, from HAWS complete line of facilities for every purpose.

ARCHITECTS, BUILDERS, SCHOOL OFFICIALS... here's an idea worthy of your attention. Write for illustrated literature, today.

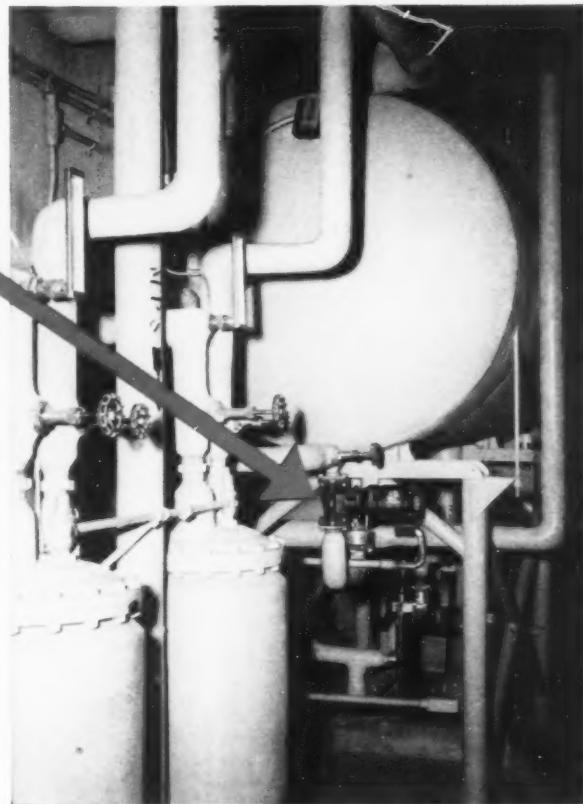
HAWS

DRINKING FAUCET COMPANY

1441 FOURTH STREET (Since 1909) BERKELEY 10, CALIFORNIA

B&G ALL-BRONZE BOOSTERS

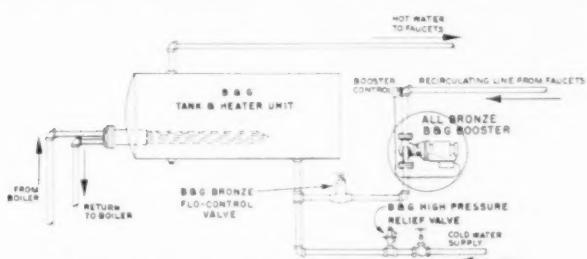
FOR LONG LIFE IN CIRCULATING HOT OR COLD RAW
SERVICE WATER FOR FAUCET OR INDUSTRIAL USES



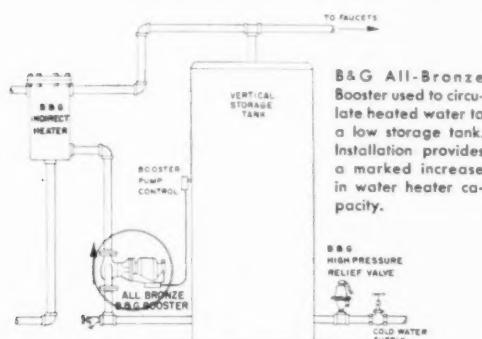
Where hot or cold service water is to be pumped, the use of an all-bronze pump is imperative. Otherwise, the corrosive effects of continuously pumping fresh water materially shortens pump life.

The B&G All-Bronze Booster is specifically built for service water pumping applications. In such systems, the Booster can be installed in numerous ways to step-up efficiency, increase hot water production and reduce heating costs. It is immune to corrosion, hence will give years of dependable service.

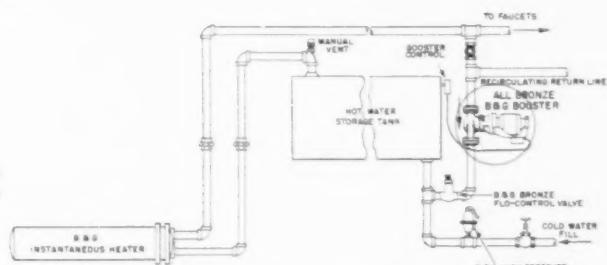
For quiet operation, failure-proof performance and long life, the B&G Booster is the preferred pump.



B&G All-Bronze Booster used on recirculating line from hot water faucets maintains hot water at fixtures at all times. Recommended on all installations, particularly where long plumbing lines are used.



B&G All-Bronze Booster used to circulate heated water to a low storage tank. Installation provides a marked increase in water heater capacity.



All-Bronze B&G Booster used to provide an extra supply of hot water from an undersized boiler. Semi-tankless hook-up maintains initial supply of hot water.

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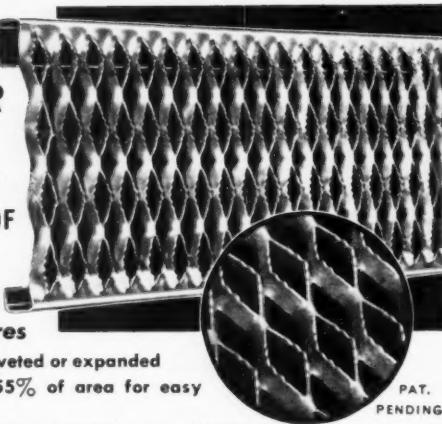
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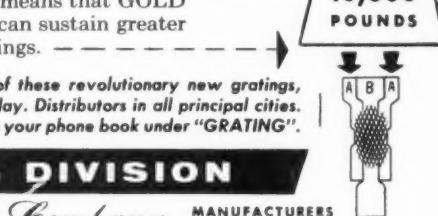
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Each secondary load bar (A), as projected welded to the primary load bar (B) has a shear strength of 5,000 pounds per weld. There are 28 such projection welds to a square foot of grating. This means that GOLD NUGGET Welded Grating can sustain greater shock loads than other gratings.



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board. Just who hears the request for incorporation will depend on whether the pleurisy or the pneumonia victim gets well first.

Pipeline Pumping

Middle East oil now is being sent to Mediterranean ports by remotely controlled pumping units, powered by gas turbine engines using crude oil tapped from the pipeline as fuel. Three staff members of the Trans-Arabian Pipe Line Company, speaking before more than 900 persons at the American Society of Mechanical Engineers Annual Gas Turbine Conference, said the portable, prefabricated pumping stations are mounted on vans and driven to remote desert locations.

The authors concluded that "the feasibility of unattended gas-turbine pumping units definitely changes the economics of pump station spacing for large-diameter pipes in the Middle East. Because of the lower investment per horsepower, the optimum spacing for unattended pumping units will be much closer . . . than for the older extremely expensive community-type (manned) stations."

Survey Status

At long last, Columbia University's Bureau of Applied Social Research has produced recommendations on procedures for conducting a comprehensive survey of the entire engineering profession. The survey will be sponsored jointly by EJC and ECPD. The recommendations have not been announced. But the suggested price is \$1,803,000 for the job.

Long Island C.E.s Meet

New York State Association of Consulting Engineers may get a new chapter, bringing the New York State total to four.

An organizational meeting has been held by what will be the Long Island Chapter. Julius Schubert, who was instrumental in initial meetings of consultants in Nassau and Suffolk counties, has been



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named temporary chairman. A second meeting was held in late March to hear the report of the constitutions committee — Horace McAlister, Farmingdale; John Stahlberg, Babylon; Robert G. Holzmacher, Hicksville; and Edwin T. Metcalf, Baldwin.

Appearing at the organizational meeting to assist the Long Island group was Frank Kulas, secretary of the New York State Association. Kulas, who also is president of the Rochester Chapter, said that his one-year-old organization now has 20 of the 21 qualified consulting engineers in the area as members of the Association.

Do it Now

The Eighth Edition of *Who's Who in Engineering* is approaching the production stage. Any engineers who were listed in former editions, but who do not return the clipping of their listing (either with or without corrections) immediately, will not be listed in the next edition.

The "Who's Who" editor said it will be assumed those not returning the clippings are either dead, retired, or lost.

More Bureaucracy

Broad new possibilities are developing in New York, the "patronage state."

A bill, being introduced into the Senate, would create a planning council and executive committee for each county. These councils would be provided with a technical staff and would be responsible for preparing master plans for county development.

The plans, with the accompanying maps, plats, charts, and descriptive matter, would include the council's recommendation on: "the general location, character and extent of major and limited access streets or highways, viaducts, subways, bridges, waterways, waterfronts, boulevards, parkways, playgrounds, squares, parks, municipally owned aviation fields, public



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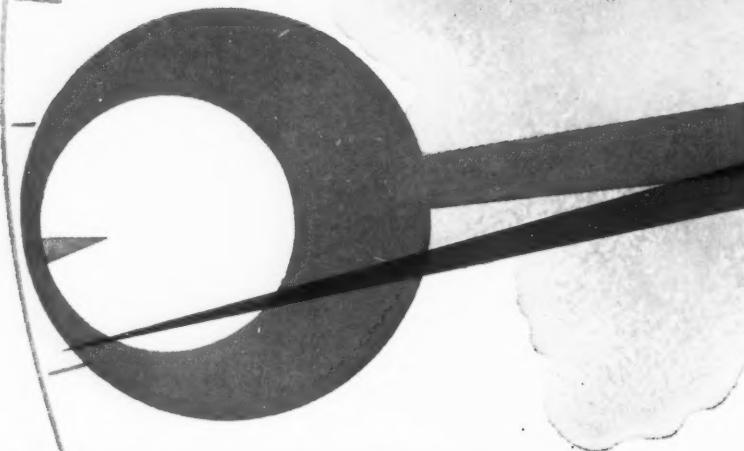
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parking spaces, and other public ways, grounds and open spaces, the general location of county buildings and other county property, and the general location and extent of public utilities and terminals whether publicly or privately operated, for water, light, sanitation, transportation and communication, power and other purposes, and also the removal, relocation, alteration, vacating, abandonment, change of use or extension of any of the foregoing features of the plan."

The council would turn the plans over to the board of supervisors. If the boards adopt the master plans, none of the facilities listed could be constructed or authorized for any parts of the counties without the approval of the council executive committee.

The executive committee and council members, who will be paid for their efforts, will be made up of members of the county, city, and village planning councils. They would be appointive by the local governing bodies.

The New York State Association of Consulting Engineers is studying the bill to estimate its effect on engineers in private practice.

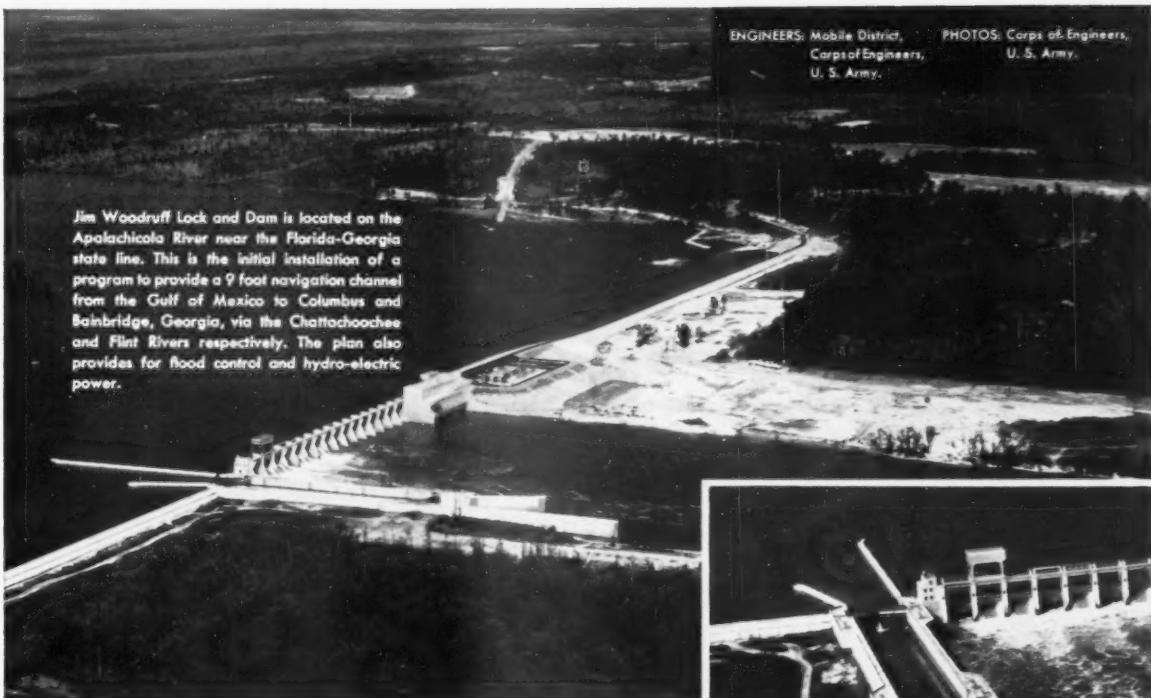
"Free Engineering" Ad Stopped

At the recent executive meeting of the Consulting Engineers Council, F. E. Dunn, general manager of the vertical pump division, Worthington Corporation, told of having all of his company's ads offering a "Free Water Table Survey Service" cancelled. He said that the advertisements originally were because of "hard sell" competition.

Dunn, who appeared in answer to a Council complaint, suggested that the Council take steps to prevent the recurrence of this type of advertising by establishing a joint committee of consulting engineers and manufacturers.

Canadian Activities

At the last meeting of the Association of Consulting Engineers of Canada, a letter and a memoran-



Jim Woodruff Lock and Dam is located on the Apalachicola River near the Florida-Georgia state line. This is the initial installation of a program to provide a 9 foot navigation channel from the Gulf of Mexico to Columbus and Bainbridge, Georgia, via the Chattahoochee and Flint Rivers respectively. The plan also provides for flood control and hydro-electric power.

ENGINEERS: Mobile District, Corps of Engineers, U. S. Army.
PHOTOS: Corps of Engineers, U. S. Army.

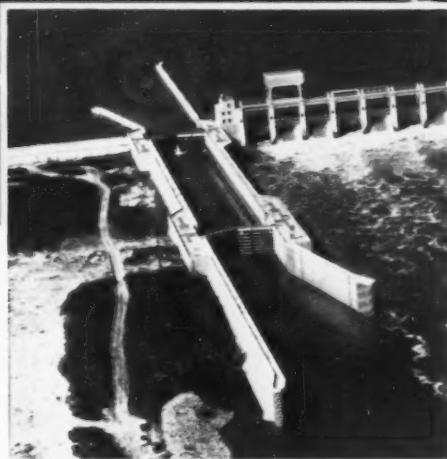
Intrusion grouting eases construction problems at Jim Woodruff Dam

The Jim Woodruff Lock and Dam Project, recently completed under the supervision of the U. S. Army Corps of Engineers, is a typical example of how effectively INTRUSION® grout can control sub-surface water. Investigation at the dam site indicated a layer of water-bearing Tampa limestone under the entire area. Army Engineers determined that extensive grouting would be necessary to prevent seepage under the dam, to increase load bearing capacities, and to hold excessive water out of excavations.

The excavation for the lock was to go 30 feet below normal river level. As material was removed to form a cofferdam, the lock area was surrounded with a temporary curtain of sanded INTRUSION grout for a total perimeter distance of some 2800 lineal feet. Grouting was not intended to stop leakage into the cofferdam but only to reduce it to a volume that could easily be handled by pumping. When excavation exposed the Tampa limestone layer, only minor seepage was evident. Even when a flood raised the river level another ten feet, the increase in water flow was very slight.

INTRUSION grout was also used under the fixed crest spillway, (large photo—left) and the gated spillway and power house, (center) to increase load bearing and to seal the permeable limestone. When lock construction was completed, a grout curtain was placed around it to minimize uplift pressures.

Information on the control of sub-surface water by INTRUSION grouting and other unique I-P methods can be obtained by contacting INTRUSION-PREPACT, INC., 568-K Union Commerce Bldg., Cleveland 14, Ohio. In Canada: INTRUSION-PREPACT, LTD., 159 Bay Street, Toronto, Ontario.



Usable lock area measures 82 x 450 feet. Maximum lift is 33 feet.



Cofferdam grouting held seepage into lock construction area to minimum. Primary grout holes were drilled on 20 foot centers. Secondary holes halfway between primaries showed Intrusion grout had penetrated limestone voids for a 10 foot radius around initial holes.



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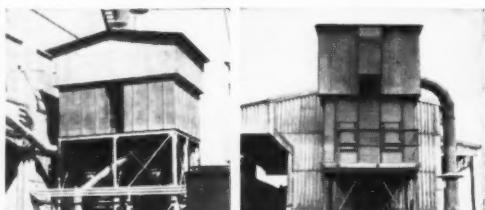
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dum were presented complaining of "the large number of foreign engineers who invade Canada and take over jobs of engineering work which normally should be carried out by our members." The memorandum also asked that action be taken against the large engineering staffs which the Canadian government was building up "to do almost all the engineering work developing from Public Works and other departments of the Government which should find its way through the regular channels of the profession." A special committee was appointed to study the problems.

Second phase of the annual meeting will be held in Quebec City on May 22, in conjunction with the annual convention of the Engineering Institute of Canada.

EJC Chicago Meeting

Engineers Joint Council has scheduled its first regional meeting for the Sherman Hotel, Chicago, on May 19. Local sponsor for the discussions of "The Next Decade in Engineering" will be the Western Society of Engineers, a professional group organized in 1869 to work on problems of all engineers.

Topics to be discussed in Chicago include "Survey of the Profession," "Education and Manpower," "Basic and Applied Research," and "Government in Science and Engineering."

CEC Incorporation Progress

Articles of incorporation have been filed by the Consulting Engineers Council with the State of Louisiana. The articles were approved at the last board of directors meeting. Chairman of this project was B. M. Dornblatt of New Orleans, Council treasurer.

Although based on the prior CEC constitution, the new articles eliminate the legal responsibility of the membership and establish the tax status as a nonprofit scientific and educational association.

Dornblatt and an attorney also were authorized to compile a new



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ties, unit heaters, convectors, Fin-Vector and baseboard were used in the modern heating system. Reason for one supplier? Dependable products . . . "one source—one responsibility" supplier!

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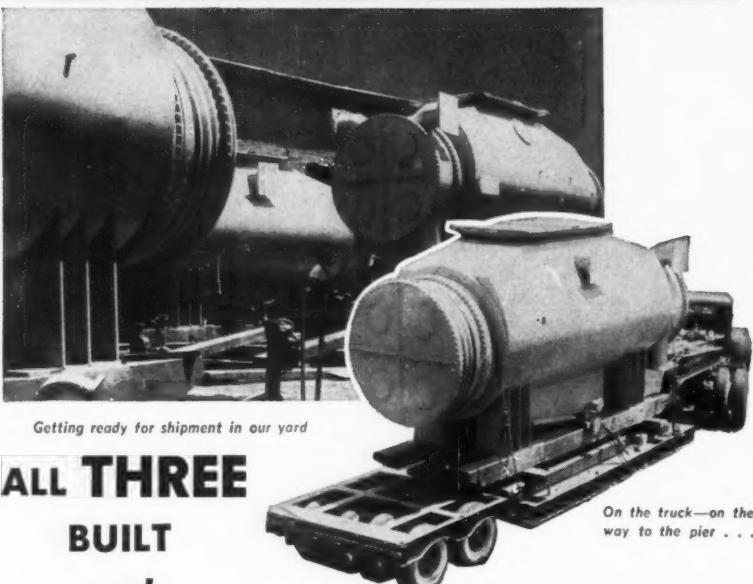
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set of bylaws to combine provisions of the present articles and bylaws and the new articles.

Employment Prospects

In a report to the National Society of Professional Engineers, Dr. Frank S. Endicott, director of placement, Northwestern University, says engineering recruitment from colleges this year will be about on a par with 1957, while nontechnical recruitment will drop 14 percent.

Dr. Endicott's report, based on a survey of 223 firms, showed the average engineering starting salary this year will be \$468, as compared to \$454 for 1957.

On a relative rating table employers want young graduates to have personality, high marks, activities, specialized courses, part-time work, and general courses.

ASRE-ASHAE Merger

H. F. Spoehr, president of the American Society of Refrigeration Engineers, reported that details of an ASRE — American Society of Heating and Air-Conditioning Engineers merger now are being discussed. However, he said an actual merger or consolidation would require two-thirds member approval.

Among the mutual advantages resulting from a merger are increased efficiency, decreased costs, and the elimination of duplicate efforts. Spoehr added that about 1200 persons are in both societies.

Inter-Society Cooperation

The Engineers Joint Council board is considering a preliminary proposal for the establishment of certain membership privileges to non-members of constituent organizations. These privileges would allow anyone who is actively participating in one society to purchase technical transcripts at membership rates from other societies.

Then, nonmembers could purchase literature at membership rates, instead of getting transcripts through member-friends, a currently popular method.



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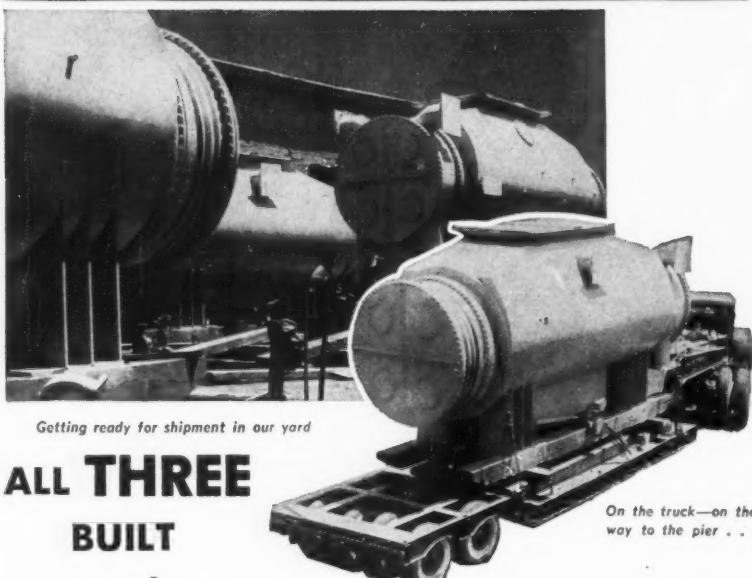
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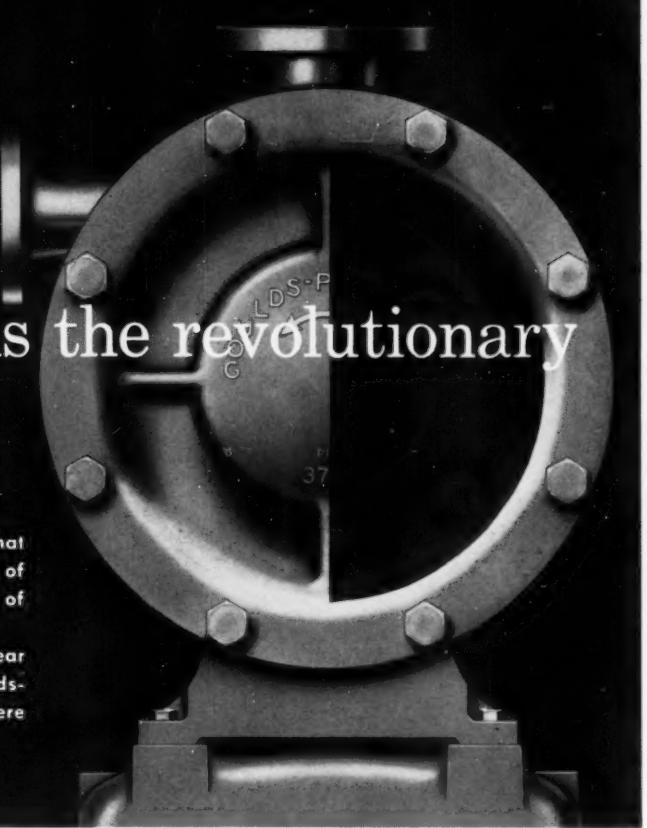
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1. Corrosion resistance. Every pump surface that touches the pumpage is glassed. The borosilicate glass formulated specifically for pump application does not depend upon a passivating film for protection. It therefore offers excellent corrosion resistance to all acids (except hydrofluoric) even at elevated temperatures to 350° F. and to alkalies at moderate temperatures.

This means long service—unmatched freedom from corrosion.

2. Elimination of stuffing box problems. The pump's unusual design places the stuffing box on the suction side of the impeller, subject to low suction pressure only. Inherently, this arrangement insures long packing or seal life and freedom

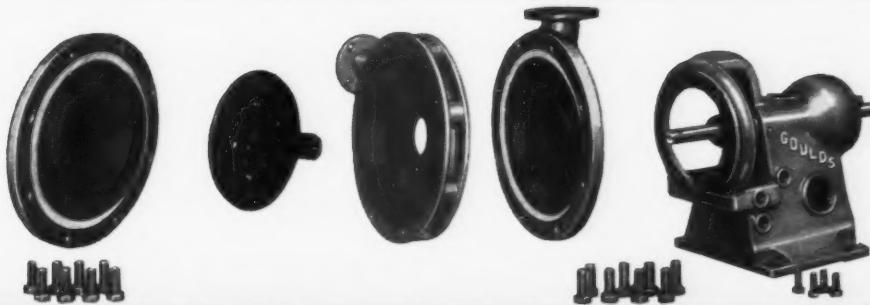
from excessive leakage.

You can get this pump with any mechanical seal arrangement to handle not only clear corrosive liquids, but also abrasive slurries. It is also available with packed stuffing box.

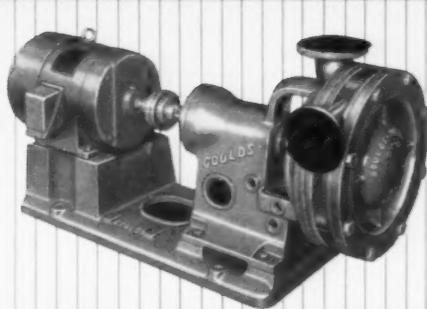
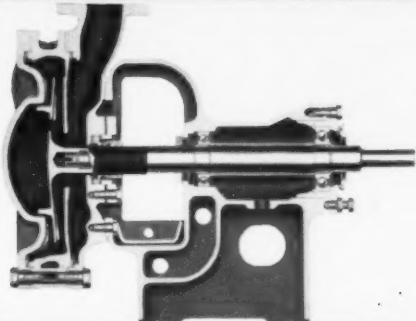
3. Freedom from contamination. Since the glass used in this pump is completely inert, the pumpage cannot "pick up" metallic or other substances which might contaminate or catalyze your reactions. Smoother than the most highly polished metals, the glassed surfaces of the Goulds-Pfaudler pump discourage product adhesion and scale build-up.

4. Mechanical strength. Goulds-Pfaudler glassed pumps are strong and durable. High temperature firings fuse the special formula glass to the metal chemically and physically, providing a permanent

GOULDS-PFAUDLER
Glassed Pumps



answer to your corrosive pumping problems



glass-to-metal bond.

The resulting combination withstands sudden temperature changes within a range of 100° F. differential—and has the durability you expect from a conventional metal pump—plus remarkable resistance to corrosion.

5. Simple centrifugal design. The glassed pump is conventional in its hydraulic design. There are no special problems of specification, installation, or maintenance. The casing design allows internal inspection, impeller and mechanical seal removal without disturbing piping connections.



6. Economy. The comparatively low cost of glass and the economy of the Goulds-Pfaudler production method combine to make these pumps less expensive than others using special materials and methods to achieve any reasonable measure of resistance to corrosion.

The first cost of a Goulds-Pfaudler glassed pump is likely to be less than you expect. The *total cost*—considering improved pumping efficiency, longer pump life, and uncontaminated process—is almost certain to be lower than any you have known in the past.

Size . . . capacity . . . head. You can choose from four different sizes of the Goulds-Pfaudler glassed pumps, and get capacities up to 700 GPM . . . heads up to 140 ft. The pumps are available for export.

Use the coupon for a bulletin containing complete information, including performance curves.

GOULDS PUMPS, INC., Seneca Falls, N. Y.

Please send me Bulletin 725.2 on the new Goulds-Pfaudler Glassed Pump.



Name..... Title.....

Company.....

Address.....

City..... Zone..... State.....



Report from the West Coast

RALPH S. TORGERSON
Consulting Engineer Correspondent

FEES HAVE BEEN GIVEN more intensive study recently by West Coast consulting engineer associations than any other subject. Both California and

Oregon association committees have done outstanding work in attempting to solve this problem. Structural and civil engineers have made more progress in establishing sound fee schedules than mechanical, electrical, and chemical engineers, but association studies reveal there is need for education in the fundamentals that determine establishment of adequate fee schedules. In the Oregon study, lack of understanding was found to be typical among consultants who recently entered private practice.

To get the benefit of experience, long-established engineers were asked by CONSULTING ENGINEER to comment on the subject.

Murray Erick, of Murray Erick Associates, Los Angeles, feels there is some excuse for the young engineer accepting work at lower fees while establishing himself. In many instances he is not sufficiently experienced to determine his productive costs. But there is no excuse for an established engineer offering his services at a reduced fee, particularly when he does so to expand his clientele to the detriment of other practicing engineers. "I especially condemn any engineer," he said, "who accepts a commission at less than a proper fee and then renders a service that he himself would consider less than first class."

On the problem of uncollected fees, Erick said, "Standard contracts usually provide for progress payments during the execution of the contract, with a substantial portion of the fees (generally from 10 to 25 percent) held back until completion of construction and acceptance by the owner. This

creates a large backlog of uncollected earned fees, which, on big projects, may not become due for one or two years after completion of design and specification services. In offices employing 15 to 25 engineers and draftsmen, this accrual will average over \$100,000. This represents invested capital on which the engineer should expect to derive a reasonable return.

"Lack of a standard measure of professional services," said Erick, "is a major factor contributing to the large amount of work done at less than adequate fees. I see no way to correct this situation, except by a long-term program of public relations designed to establish the importance of the engineer in the eyes of the public."

Erick feels that a lack of proper accounting practices contributes to the difficulties of establishing adequate engineering fees. His monthly audit report is set up to show these production costs:

- Direct Expenses
 - Partners' Salaries
 - Productive Salaries
 - Payroll Taxes
 - Professional Fees (paid to other engineers or architects retained by the firm)
 - Blueprints
 - Drafting Supplies
 - Indirect Expenses
 - Partners' Salaries
 - Nonproductive Salaries
 - Overtime Premium Pay
 - Rent
 - Depreciation of Furniture and Equipment
 - Amortization of Leasehold Improvements
- Then, administrative and general expenses, which include contributions and interest, also must be add-

new

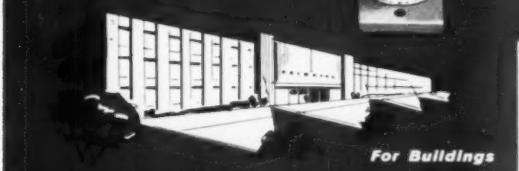
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YOURS ON REQUEST: Big 20-page Power Line Catalog gives complete facts about industrial ventilation, including selection of proper type and size of fan, calculation of duct resistance, and installation procedures, plus features, dimensions, specifications and performance data. Without obligation write for your free copy of Catalog No. 11.

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ed to costs, and when these and the production costs are deducted from income from services, there is left a figure showing net profit for the period, before employee participation. Deduction of employee participation leaves the net profit on a cash basis. Administrative and general expenses include a number of items that some engineers overlook in making cost estimates. It is important to include:

- Partners' Salaries
- Office Salaries
- Telephone and Telegraph
- Promotion and Entertainment
- Travel Expenses
- Advertising
- Automobile Upkeep
- Office Supplies
- Postage
- Dues and Subscriptions
- Office Expenses
- Interest
- Insurance
- Group Insurance; Hospitalization
- Employee Welfare
- Professional Fees; CPA and Legal
- Taxes and Licenses
- Depreciation of Automobiles

In addition to the monthly audit, a running log is kept on each job in progress. This log includes the hours spent, direct productive salaries, and estimated percentage of completion as of end of each month.

Partners' Salaries

Note that partners' salaries are broken down into three items of cost: direct productive expenses (actual time devoted to preliminaries and design); indirect productive expenses (consultation and supervisory services both in the drafting room and on the job); and administrative and general expenses, which are not directly chargeable to a particular project.

In some offices, the partners' salaries are not considered expenses, primarily because they are not allowed as expenses from an income tax standpoint. Erick believes that the salaries principals could command if working for someone else should rightfully be charged as a



From suspension towers to completion

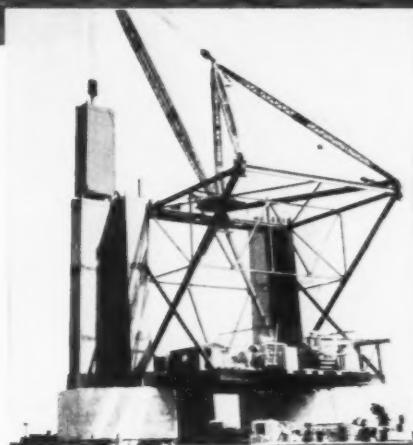
Clyde Hoists 'Pull' World's Longest Suspension Bridge Across Mackinac Straits

On the construction of the famous Mackinac Straits Bridge by American Bridge Division, United States Steel Corp., Clyde Hoists were used throughout the operation from erection of the suspension towers to completion of the bridge itself.

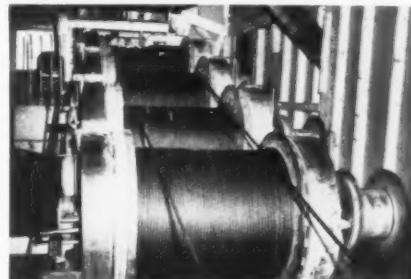
Time is big money on a project of this size. Any down time throws a monkey wrench into working schedules and makes costs climb rapidly. For dependable and continuous operation, leading contractors all over the world select Clyde Hoists. Their all steel bed and side frames provide exceptional ruggedness without excessive weight. Large diameter brakes and internal, expanding band friction clutches give smooth and positive load control. Anti-friction bearings throughout reduce maintenance . . . more advantages that owners and operators like in Clyde Hoists.

It takes a lot of features to add up to a superior quality, work-hungry hoist . . . one that will smoothly and swiftly spot loads with safety, without operator fatigue and without down time. All these and many other outstanding and exclusive features of Clyde Hoists are the result of the 60 years of engineering and manufacturing know-how that goes into every Clyde.

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Powerful, 4-drum Clyde Hoists with 21,000 pound line pull operate the traveling derricks to set columns of the suspension towers on the Mackinac Straits Bridge job.



The husky brakes and band friction clutches of these mighty Clyde Hoists, made it possible to accurately position the heavy bridge members with ease and safety.

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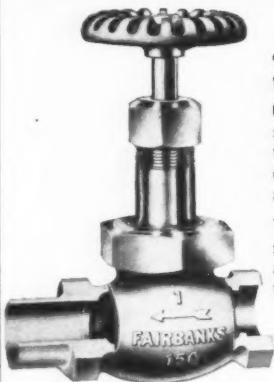
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The silver brazed connection withstands tension, compression, torsion and vibration to a far greater degree than any other type joint.



Solder End Threadless Valves for soldered joints. Get perfect seal of valves for type "K", "L" and "M" copper tubing with Fairbanks Solder End Threadless Valves. Simple, quick installation provides a smooth, compact, full flow assembly that has high resistance to corrosion.

Full line of Fairbanks Solder End Threadless Valves—Globes, Gates and Checks—have an unusually wide application range.



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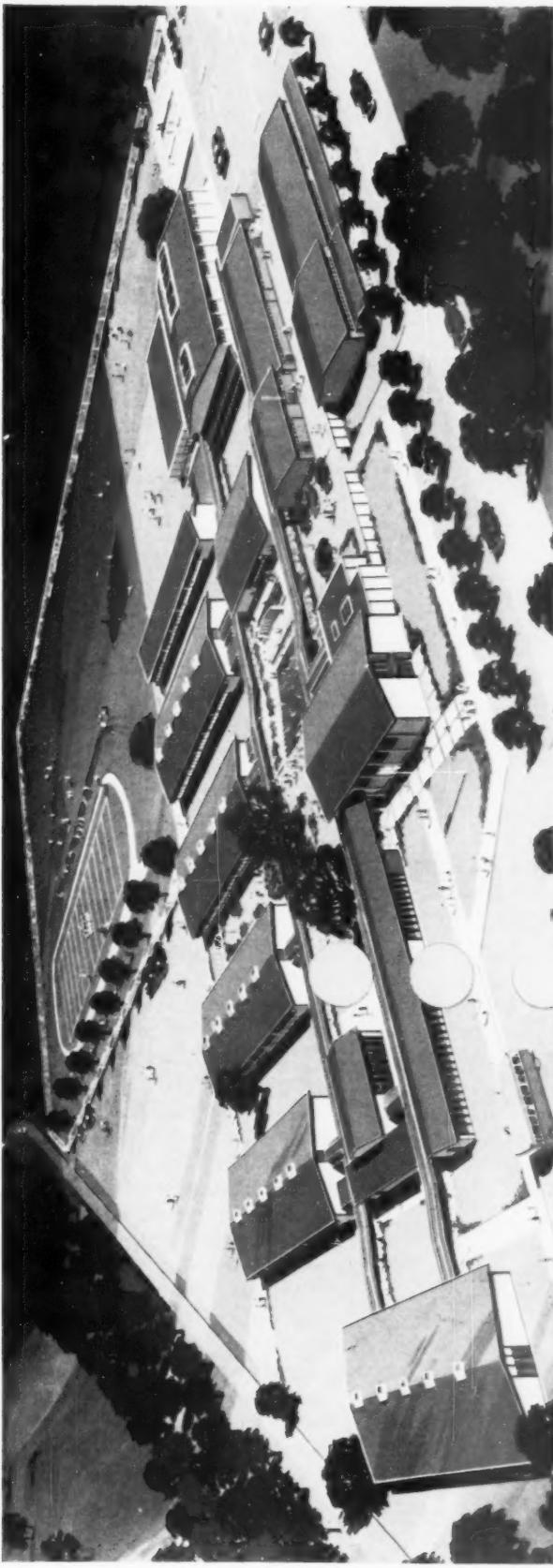
cost of doing business, and the business should be analyzed on that basis. His audits over several years show that when calculated this way, average profits are between 2 and 2½ times the total salaries of all principals.

The Erick firm uses three basic types of contracts: fees based on a percentage of the total construction costs of the project; an occasional negotiated lump-sum fee; and a cost-plus on alteration work and relatively small projects. This cost-plus is usually 2½ times direct productive salaries, including the direct time of principals.

The percentage fee contract is used for a wide range of different types of projects. Erick prefers basing structural engineering fees on total construction cost instead of structural costs only because an accurate breakdown of purely structural costs is impractical. Most clients, he has found, resist open-end contracts, except where a maximum is established. Erick, however, does not like the open-end contract with a guaranteed maximum because this maximum is about the same as a straight percentage or lump-sum contract, and there is only one direction the fee can go — down. If difficult problems are encountered, the engineer still gets no more than the agreed maximum.

Joseph Sheffet, chairman of the Engineers Fee Committee of the California Association of Consulting Engineers, believes that inadequate fees exist because the average engineer has a low opinion of his own worth and undervalues his services. Also, the engineer starting out often does not have a true concept of overhead costs. Sheffet mentioned, too, the problems arising from wide fluctuations of income from year to year. Payments may be unusually large one year because of delayed payments. For income-tax purposes, he feels it best to operate on a cash rather than an accrual basis.

Commenting generally on the problem, S. B. Barnes, structural

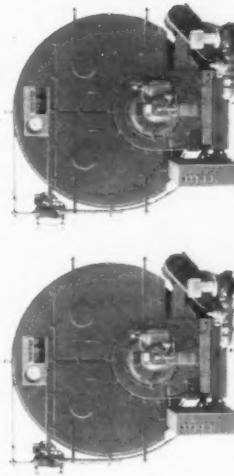


Clayton Valley High School, Clayton, California. Architects: Associated Architects

Consulting Engineer: Clyde Bentley, Heating & Ventilating Contractors; Walnut Creek Sheet Metal & Furnace Company, Inc. and Carslens & Sigler.

Proven heating performance, local service win again for Webco-Ray packaged units

Two dependable Webco-Ray three-pass packaged units were selected to provide safe, silent heating performance for this new \$1,901,000 school project. With 5,850,000 BTU/hr output for each boiler, the two Webco-Ray units furnish enough hot water for convectors and unit ventilators to heat the entire school. But one of the big plus factors in choosing Webco-Ray was the local service follow-up. Nearby distributors not only fire, test and adjust the boilers to start with, but follow-up with constant service availability. You deal with one single responsible source when you specify Webco-Ray heating, power and process steam units. And nobody can cover with service like Webco-Ray.



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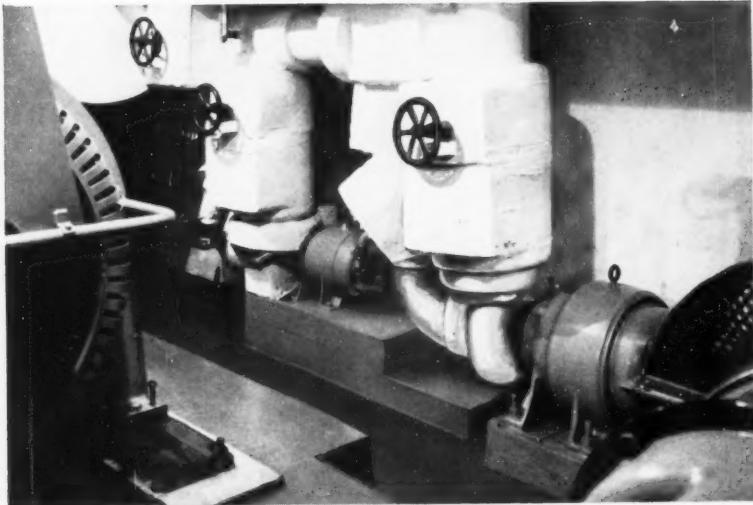
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Completely adaptable, Weinman General Service Unipumps operate efficiently and dependably in any position. Horizontally, vertically, on floors or walls.

Extreme unit compactness makes Weinman General Service Unipumps ideal for installations in limited space area.

Available in a range of $\frac{1}{2}$ to 50 horsepower, Weinman General Service Unipumps can be purchased with either enclosed or open type impellers, in capacities to 1700 gpm, with heads to 260 feet!

Ask your Weinman Pump Specialist for all the facts about economical, versatile Weinman General Service Unipumps. He'll answer all your questions. You'll find his name listed in the yellow pages of your telephone book.

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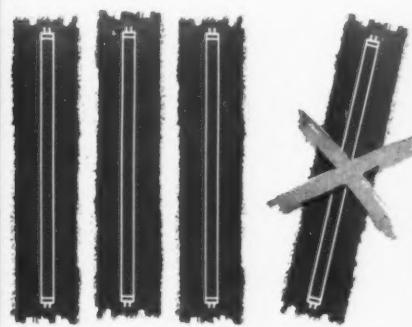
engineer, of Los Angeles, said "Engineering fees can be set up any number of ways. Inadequate fees are the result of ignorance of what it costs to do business. Civil and structural engineers, at least in California, have fairly good fee standards. ASCE Bulletin 29 is a generally satisfactory guide. However, it is much more difficult to standardize fees for mechanical and electrical engineering. The main thing is an adequate amount for overhead, then an added amount to provide a reasonable profit."

Analyzing the Job

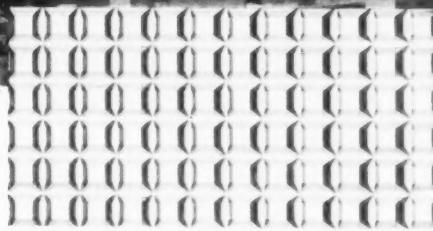
J. S. Hamel, Burbank, does not estimate fees on a percentage basis. He uses a percentage, however, as a check and guide to see if his fee is in line with standard practices. He analyzes a job on the basis of scope of work; time; class of work; and client location.

"We break the job down to the number of drawings which have to be prepared," said Hamel, "knowing the class and type of work, using figures gained through these drawings, including designs, specifications, and estimates, and from this arrive at a total estimated cost. To this we add our known office overhead. This varies from 60 to 90 percent, depending on the office work load. This percentage is based on total cost of production, including direct labor and taxes applicable to direct labor. Indirect costs such as fuel, light, power, rent, and officers' salaries, are classified as overhead. To this total we add a percentage for profit. This profit percentage varies from 10 to 20 percent, depending upon the class of work involved. It should never be less than 10 percent."

"We take this total — job cost, overhead, and profit — and check this against what would be considered an accepted percentage fee for the work. Many times our estimated total may be well over the percentage normally accepted, or it may be below. Then, it is up to us to decide whether we will



three lamps do more than four with Prismoid



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Contractor: L & W Elec. Co., Rock Island, Ill.

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Originally, this job was laid out for 50 footcandles with Brand X fixtures (4 lamp—75 watt).

But McCabe bought Guth Peerlites with Prismoid Louvers, using only three 75-watt lamps.

Result: 100% more light than with the 4-lighters!

And more! The crystal beauty and cheerful atmosphere created by Prismoid flatters the merchandise and puts shoppers in a buying mood.

**100 FOOTCANDLES WITH ONLY
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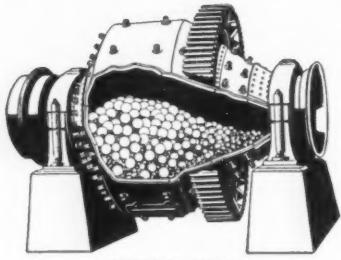
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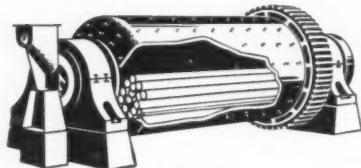
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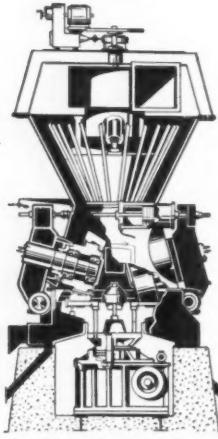
GRINDING AND PULVERIZING



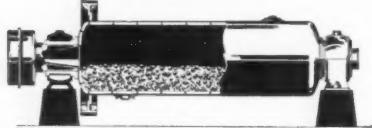
CONICAL MILLS



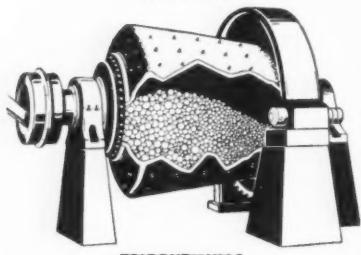
ROD MILLS



DISC-ROLL MILLS



TUBE MILLS



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No matter what your grinding problem — coarse or fine grind — hard or soft material — Hardinge has a mill for the job. Check the applications of the different Hardinge Mills below:

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The shape of the Hardinge Conical Mill causes a rapid circulating and classifying action within the drum, which increases the capacity for power expended over other types. The range of grinding is large, due to the segregation of the sizes within the mill. Size range from 2 feet to 10 feet with capacities from a few pounds per hour to 100 tons per hour. Bulletin 17-C-64 gives dry grinding applications; Bulletin AH-389-64 wet grinding.

ROD MILLS

Steel rods are employed as grinding media. Ideal for producing minimum oversize in open circuit grinding. Convex or conical heads reduce friction, prevent congestion of charge at the ends, and align the rods. Available with either end, or center, peripheral discharge, as well as trunnion overflow. Bulletin 25-C-64.

DISC-ROLL MILLS

An adaption of the German "Loesche Mill." A roller-mill with rotating grinding table and pneumatically-loaded rolls for complete flexibility of operation. The "Gyrotor" Classifier, combined with the Disc Roll Mill, provides a highly-efficient dry-grinding device, ideal for relatively soft minerals. Bulletin 52-64.

TUBE MILLS

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Built on the same principles as the Conical Mill, the Tricone Mill offers greater grinding volume for a given amount of floor space than any other tumbling mill built. Extremely efficient. Ideal for large tonnages. Sizes up to 12 ft. diameter. Bulletin AH-414-64.

charge what we honestly think the job is worth, or increase this cost to make up for any inequities in our estimates. Our experience has shown that when we stick by our costs, we are more nearly right than when we take a fixed percent.

"As another extreme, a job with an unknown scope of work and an unkown length of time for performance usually is taken on a strictly cost-plus basis. Then, we use two methods. The first is $2\frac{1}{2}$ times drafting costs for normal production work. Where the work involves a great deal of time by officers and engineers whose salaries are included in overhead costs and cannot be charged off directly, we ask for a retainer and bill drafting costs at twice timecard costs. The retainer is figured to include the time of principals of the firm and the profit to be earned."

Hamel believes that an honestly estimated fee is usually better for both the engineer and the client. "We have found that an estimated lump-sum fee may be substantially under the going percentage cost; however, the client recognizes that we are operating on a businesslike basis, and repeat jobs are more frequent than when the client pays a fixed percentage and feels that he has been 'taken for a ride.' That does not lead to good relations."

A New Approach

Hugh B. Brewster, a civil engineer, of Fresno, points out fee considerations are twofold: the engineer should make a profit, and the client should make a profit. "The problem we are all faced with," said Brewster, "is how to arrive at a fee that can fulfill these considerations and still be acceptable to the client. As an engineer, I find the arbitrary percentages, curves, and charts adequate, but I can find no logical reason behind them. This is a stumbling-block if your client asks why you charge instead of 8 or $6\frac{1}{2}$ percent.

"When a client engages an engineer he usually has two questions

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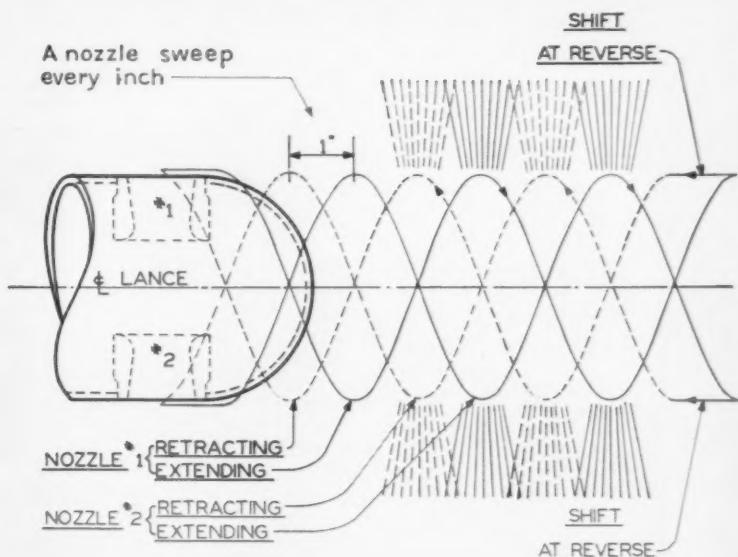
New



Series 300 IK LONG RETRACTING BLOWER

The positively-controlled, close helical cleaning pattern assures optimum coverage of the heating surface. Return travel path is exactly intermediate to forward travel path . . . resulting in a positive nozzle sweep every inch.

This is another of many reasons why the Diamond Series 300 IK Blower does a better and more economical job of cleaning surfaces which require a long retracting blower. Other advantages are listed at the bottom of the page. Ask the nearest Diamond office or write directly to Lancaster for Bulletin 2111 CE which will tell you much more about the new Series 300 IK.



**Nozzle-sweep-every-inch blowing pattern
assures COMPLETE coverage
of ALL surface EVERY time**



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Windsor, Ontario

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No other blower gives you all these advantages.

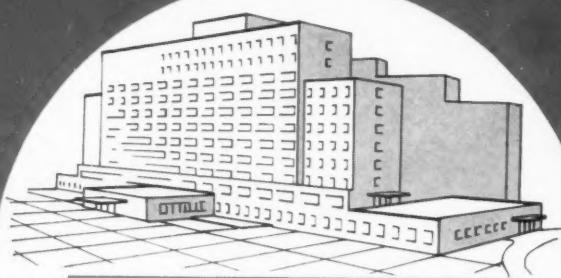
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ECONOMICAL
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RELAYS  LONG BRANCH, N.J.

Wheelock SIGNALS INC.

in mind: how can the engineer help me and how much is it going to cost. If the engineer can satisfactorily answer the first question, he usually has at the same time shown his prospective client that the engineer will save money.

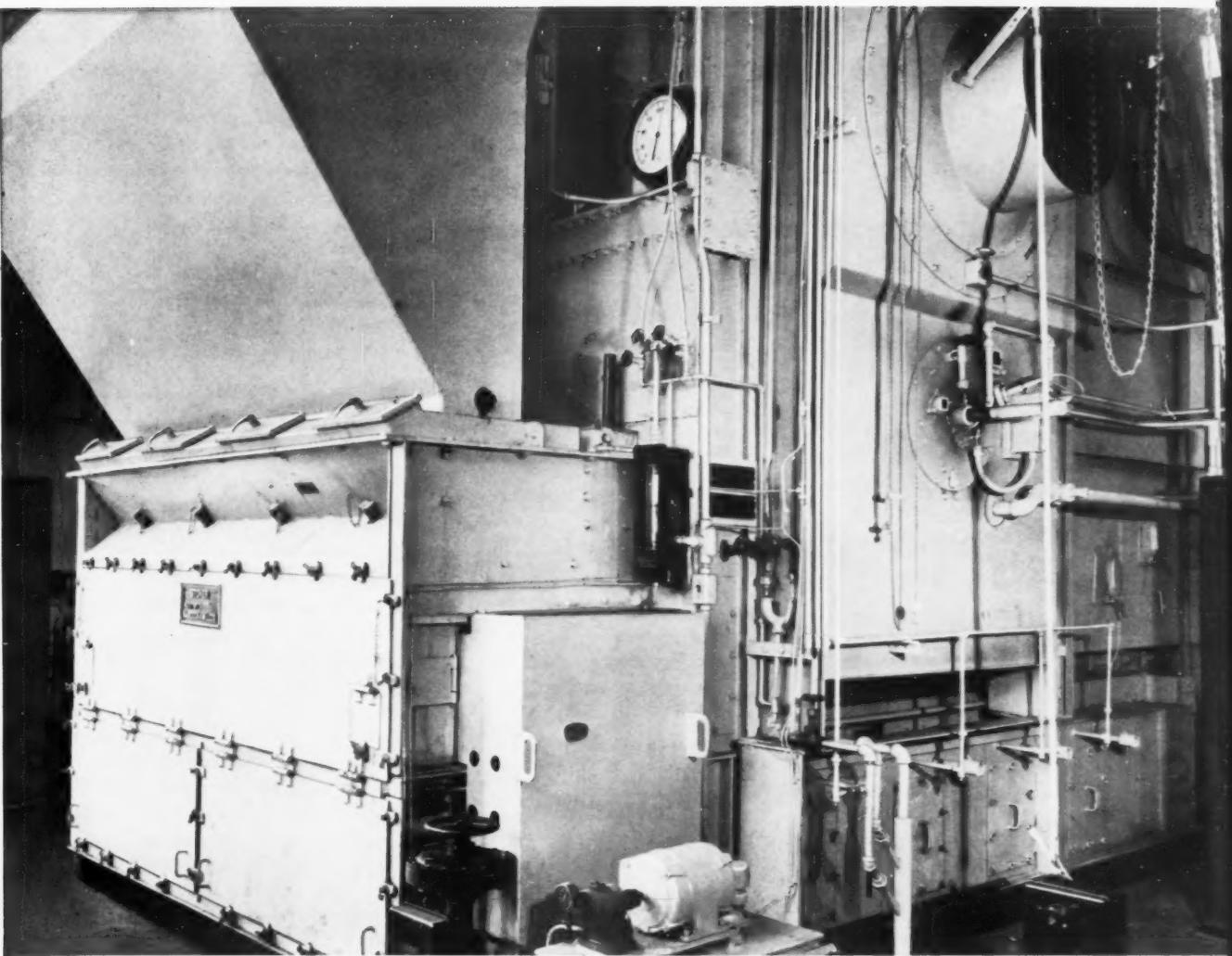
"To answer my own question of how to arrive at a fee that satisfies the basic requirements and also satisfies the client, I feel the engineer's fee should be based on the calculated annual profit on the client's investment, as affected by the work done by the engineer. Conversely, if costs go above a set maximum, the engineer's fee goes down. (A minimum is indicated here.) In other words, the engineer gets paid in proportion to the benefit he has provided his client. This way the client can really see how his engineer helped him and will understand the fee."

Substandard Fees

Leslie W. Graham, of Graham and Hayes, San Francisco, believes too many engineers just starting practice overlook many overhead items, either deliberately or through failure to realize they are there. When these engineers start out, their overhead is small, and they are able to show a profit with smaller fees. "When their reduced fees lead to an increase in work," Graham said, "they are forced to enlarge their office and add non-productive personnel. Then they find their overhead has increased to that of an established firm, and they begin to operate at a loss. Now they find it is difficult to increase fees to clients attracted by their low fees. Lowering fees makes it difficult for older, more established firms and downgrades the profession — hurting everyone concerned.

"Our fees are computed in two ways: on a percentage of the total cost of the project; or an agreed-upon multiplying factor of the direct labor cost in designing and supervising the job.

"In general, the percentages recognized as standard in this area



B&W Integral-Furnace Boiler at Case Institute of Technology, Cleveland, Ohio, has a capacity of 24,000 lb of steam per hr at operating pressure of 225 psi and design pressure

of 250 psi. Consulting Engineer: McGeorge-Hargett & Associates, Cleveland. Illustration above shows a view of the stoker in the front wall and gas burner in side wall.

B&W INTEGRAL-FURNACE BOILER PROVES VERSATILITY AT CASE INSTITUTE

Specially Designed Firing System Provides Two Steam Output Ranges

Faced with the problem of heavy steam loads in winter and greatly reduced loads in summer, Case Institute of Technology, Cleveland, Ohio, installed a B&W Integral-Furnace Boiler with a dual firing system.

To answer heavy load requirements during the winter heating season, the boiler is fired by a B&W Jet-Ignition Stoker. Operating as a coal-burning unit, it economically supplies steam for heating, laboratories, and other uses at 6,000 to 24,000 lb of

steam per hr. During the light load summer months, boiler-firing switches to a natural gas unit built into the furnace wall. This forced draft burner is fitted with automatic combustion controls for a lower steaming range of 2,000 to 10,000 lb of steam per hr.

Flexibility of operation in this B&W installation is a highly economical answer to the "peak and valley" seasonal demand faced by Case. The two firing arrangements operate completely independent of each other.

Efficient, trouble-free performance is another reason why B&W Integral-Furnace Boilers are consistently selected by institutions

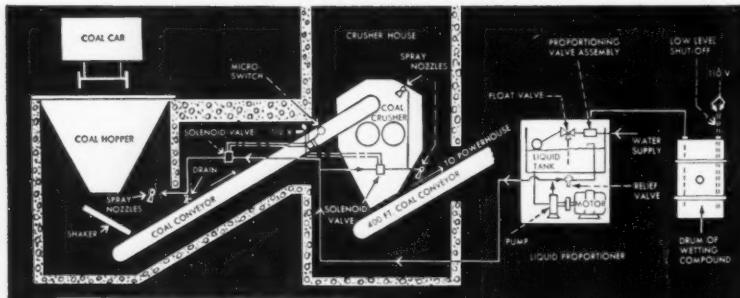
and for commercial and industrial installations throughout the country. Completely integrated units, B&W Boilers are backed by the undivided responsibility of one manufacturer with nearly a century of steam generating experience, and a national network of plants and field engineers. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

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DUST CONTROL ENGINEERS
1724 Chestnut Street, Philadelphia 3, Pa.

return the proper profit. It is my opinion, however, no one charges consistently these accepted theoretical percentages. Most fees are lower. The multiplying factor always should be high enough to cover direct costs, all overhead costs, and a reasonable profit. For us, this factor ranges between 2½ and 3 times the direct labor cost."

Washington Fee Problems

Some of the fee problems of consulting engineers in the State of Washington are mentioned by Allen E. Hill, of Hill and Ingman, Seattle. "Our firm is doing the engineering for quite a few sewer districts. A sewer district, under Washington laws, is a municipal corporation formed for the express purpose of developing, building, and operating a sewerage system in rural areas outside of incorporated cities and towns. These districts, when set up, have no engineering or office staff and therefore need administrative services which can only be provided by consulting engineers. The district officials meet from one to four times a month, depending upon the district, and the consulting engineer is required to attend the meetings so any engineering questions that arise can be answered promptly.

"Many of the new engineers or older engineering firms not acquainted with this type of client offer engineering services for a sewer system, not realizing that there will be years of administrative engineering. At the beginning the sewer district or client does not have a dime and, therefore, the preliminary services for several years have to be on a contingency basis. In our opinion, after approximately 15 years of working with this type of client, the engineering fees should be, in general, as follows: the actual design, plans, and specifications for the construction of any phase of a sewer system should be on a percentage of the cost of construction. The other allied services, such as assessment

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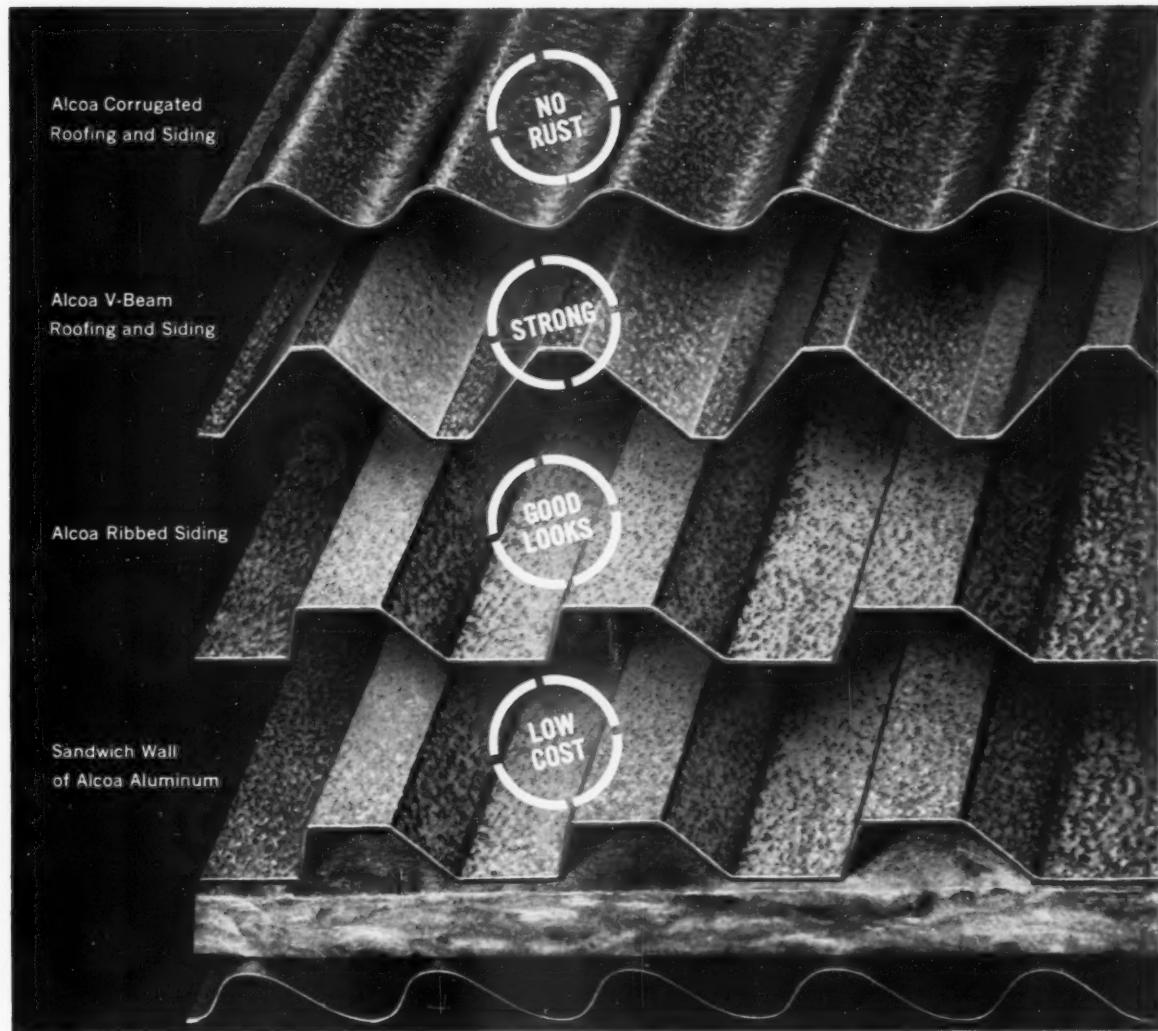
rolls, attending meetings, administrative engineering, and reports and studies should be on a time basis because of the unknown and unpredictable amount of work involved. The construction phase also can be set forth as a percentage, provided the client readily understands the problems involved and the specifications allow the engineer to be paid by the contractor for all overtime work necessitated by actions of the contractor.

"In some instances, and especially in the early years of the new sewer district, the client will not have sufficient funds to pay for necessary additional or outside services. Therefore, the engineer should be allowed to collect a higher-than-normal percentage fee when the project is constructed and financed. In this way, the engineer tends to finance his client, but on the other hand, the client is paying the engineer for the additional services that are demanded of him. If any single phase of the program is looked at, an outsider might say that the engineer was receiving too high a percentage for his services for, say, a half-million-dollar improvement, but if a careful investigation were made of the client-engineer relationship over a period of years, it would be seen that the payments were in line with the value of the services received.

"With many of our clients who have small projects from time to time, a normal engineering fee on the percentage of the cost of construction is not feasible, so we try to receive our payments on a time-and-material basis, and fall back on the percentage fee if the client has a larger installation.

"We also have other clients for whom we perform specific services for lump sums. We very seldom have two contracts that are identical, as each contract reflects the peculiarities of the situation under which the engineers have to perform their services."

Philip F. Spaulding, of Philip F. Spaulding and Associates, Seattle,



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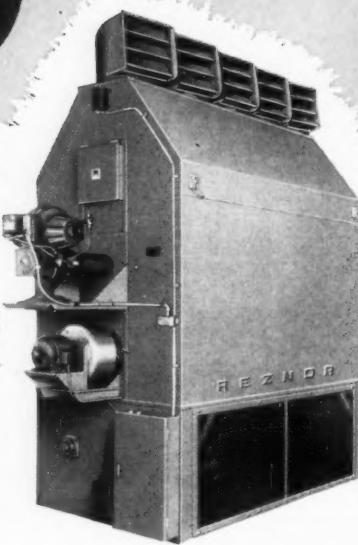
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Reznor-Olson heaters are available in ten sizes—400,000 to 2,000,000 Btu—with gas, oil or dual-fuel burners. They may be floor mounted for top discharge or suspended for down-blast or horizontal discharge.

New Bulletin gives Complete Specifications

Complete specification information—including dimensions, control details, temperature rise, air delivery and fuel consumption—is included in a new bulletin, F-57A-RO. If you don't have a copy of this bulletin in your files, just fill out and mail the coupon below. Do it today.



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said fee levels are the largest single problem facing an engineering firm today. "Fee cutting to obtain work," said Spaulding, "is the curse of non-professionalism. Our experience indicates that governmental agencies — Federal, state, and county — too often resort to unprofessional methods in asking for and getting competitive bids for engineering services. In the press of making a living or trying to keep an organization going, some engineering firms resort to these nonprofessional practices. Anything that helps to put engineering work on an established fee basis will be greatly appreciated by our firm."

CEAC Activities

Two important resolutions were drawn up by CEAC at their January 18 meeting. One was aimed at the California Department of Water Resources' recent move to provide engineering service to Tuolumne County Water District No. 2. The resolution pointed out that the State Legislature did not intend that such a State agency would perform services of any kind for either public or private agencies other than the State; and that existing competent private consulting engineering firms are available to provide such services.

The second resolution dealt with a statement in a recent U.S. Chamber of Commerce booklet, "Businessmen's Guide to the Road Program." The paragraph, which affects all consulting engineers, reads:

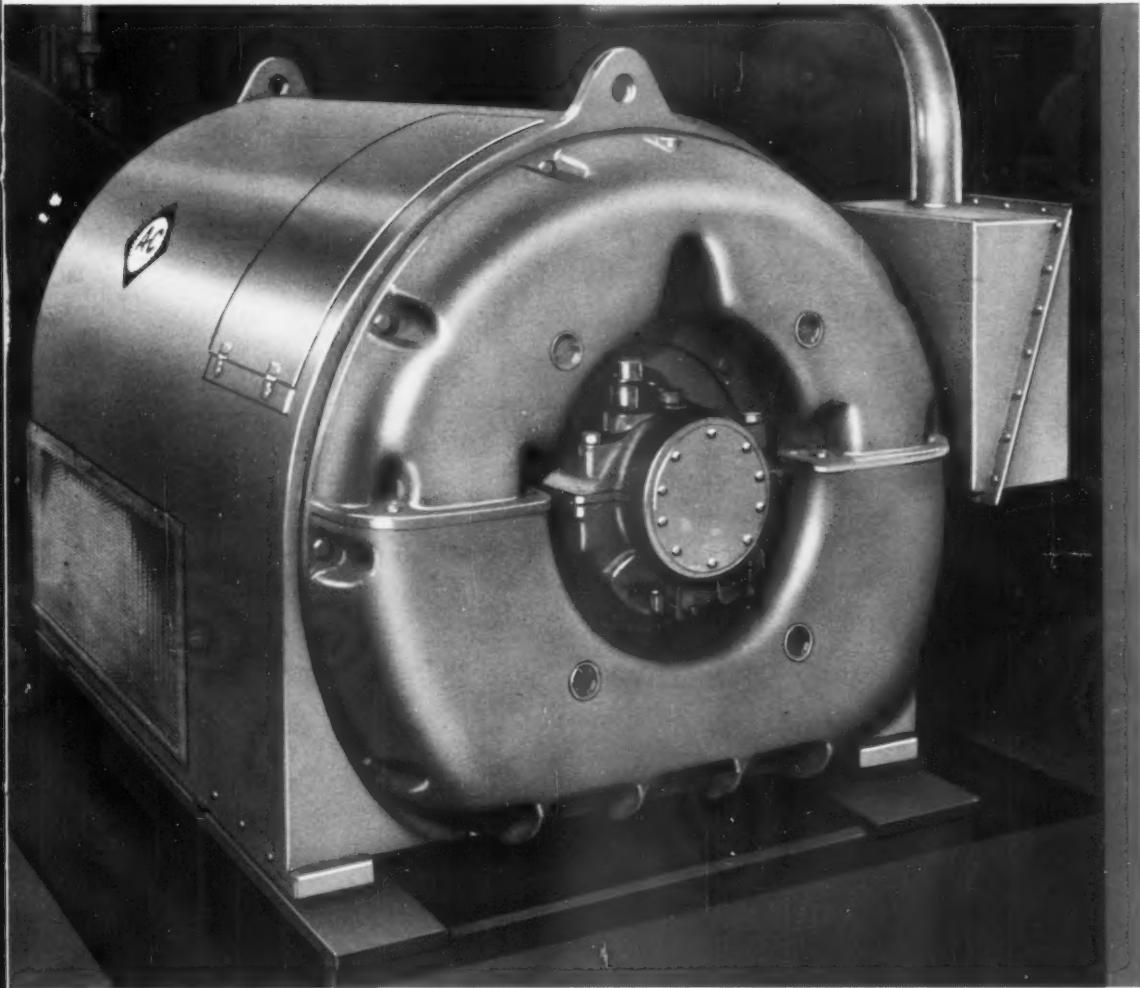
"Engineers today are in great demand. Both Federal and State highway organizations are already being raided by outside organizations. Of course, there is a place for the consulting engineer in this work but remember that, for the long pull, the public interest will be best and most economically served as the tax dollar is invested in your own public engineering organizations."

It was requested by the association that this misleading information be corrected!

Revolutionary Advance in Motor Protection

made possible by **SILCO-FLEX** insulation

plus 10 integrated mechanical features

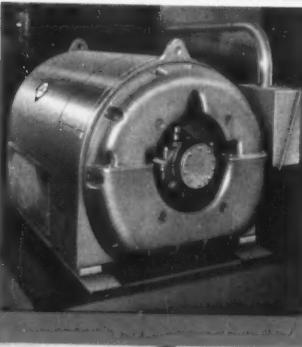


Designed to meet needs of chemical, paper, petroleum, metals, power and rock products industries where moisture, dirt, abrasive dusts or corrosive atmospheres are a problem.

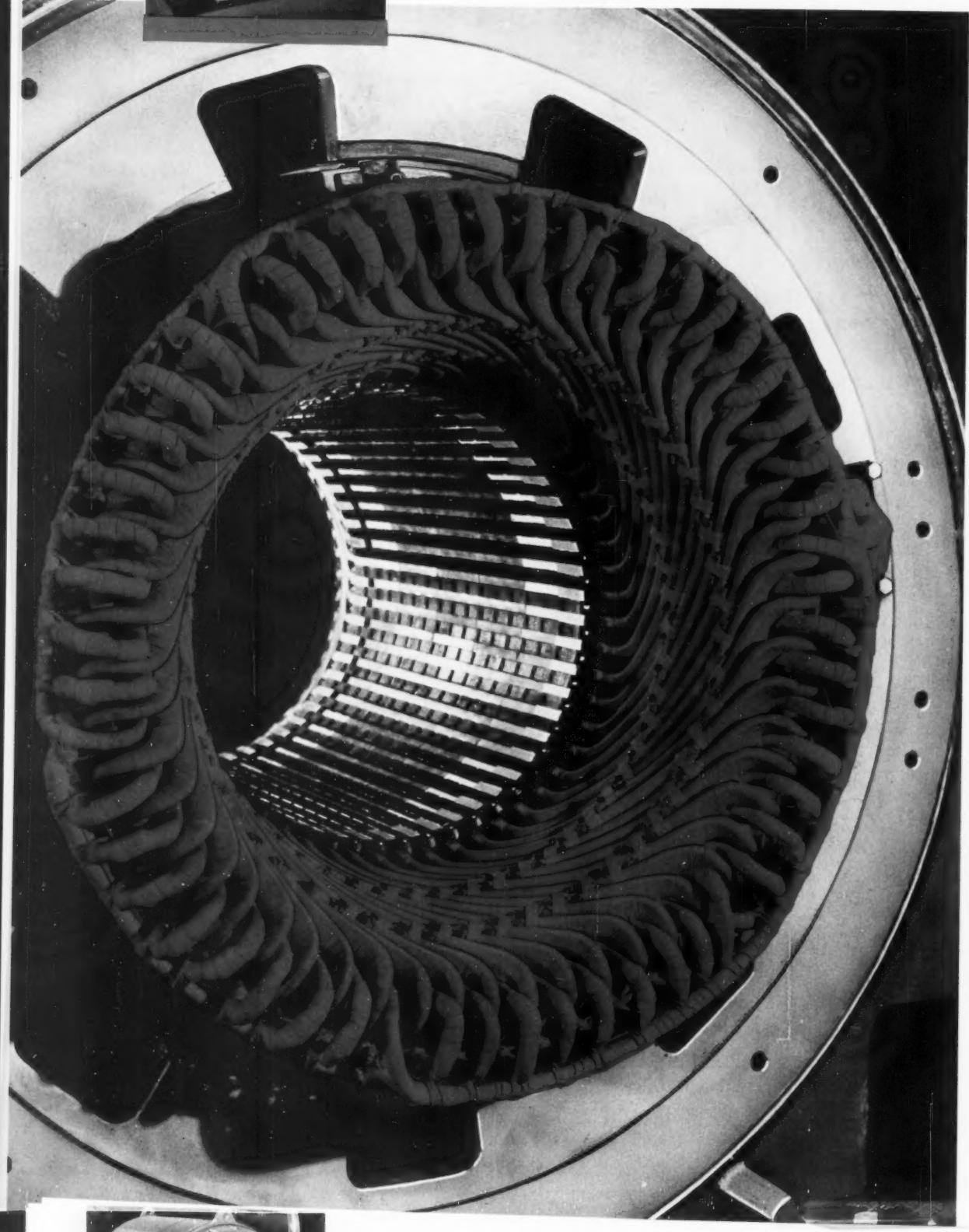
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A-5636



New Motor is



super-sealed

**It's drip-proof — yet withstands moisture •
abrasive dust • chemicals • high humidity • heat**

The *Silco-Flex* system of insulation is used on all stators. Field coils of synchronous motors are bonded in heat-stabilized resins, enclosed in a resin-impregnated sheath of oriented glass fibers and bond-locked on the pole structure.

The superior electrical protection of Super-Sealed motors results from the insulating *system* used...not just the insulating material. The same material, conventionally applied, would retain certain weaknesses of conventional insulation.

Applied the A-C way, it has these qualities that add reliability and service life:

Dimensionally stable —

withstands heating, thermal shock, vibration and fatigue at elevated temperatures.

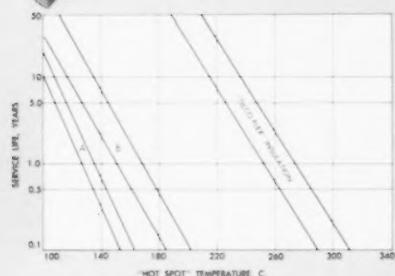


Homogeneous — provides a void-free dielectric barrier, homogeneous under extremes of differential expansion and contraction due to thermal cycling.

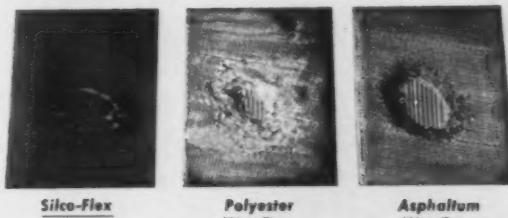
Sealed throughout —

resistant to most chemicals, water, high humidity, weather, aging, corona and lubricants.

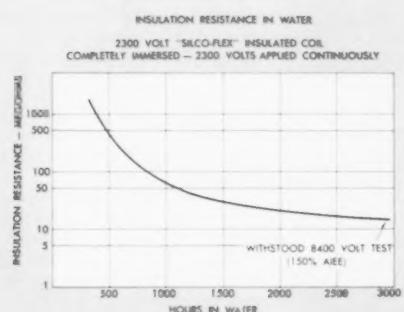
All Super-Sealed motors have revolutionary Silco-Flex insulation



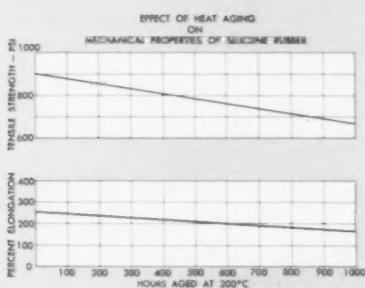
Heat resistant — Silco-Flex insulation gives much longer service life under higher temperatures than conventional materials.



Abrasion resistant — Samples of insulation show effect after sandblasting for one minute with 90-grit aluminum oxide and 100-psi air. Nozzle to sample distance was six inches, thickness equivalent to 2300-volt insulation. Note difference in abrasion.



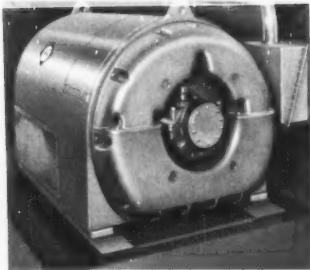
Moisture resistant — Test curve shows that Silco-Flex insulation, after 3000 hours of total immersion with 2300 volts impressed on coil, withstood high potential test of 8400 volts without injury.



Flexible, resilient — Rubbery Silco-Flex insulation remains flexible and resistant indefinitely. It is especially resistant to mechanical abuse and to stresses of overloading, rapid starting and stopping.

Silco Flex is an Allis-Chalmers trademark.

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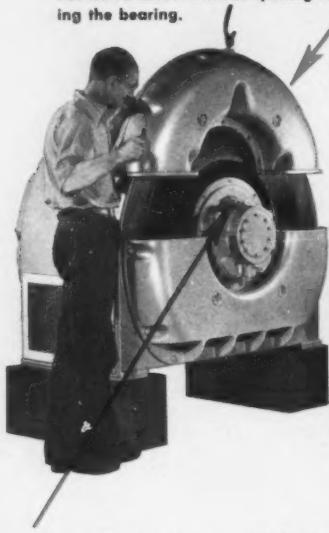


New Super-Sealed motors

10 mechanical features

Super-Sealed motors combine the perfect insulation with features that assure the mechanical as well as the electrical reliability of these motors.

Accessibility — Split-type end shields can be removed without opening or disturbing the bearing.



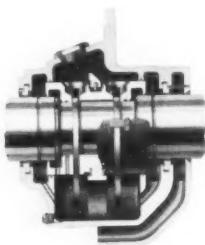
Ease of Inspection — Four points are provided for measuring air gap.



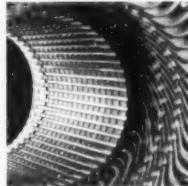
Clean Check — Glass inspection bulls-eye permits checking operation of oil rings without dirt falling inside bearing.

Full Circle of Protection — Steel plate across bottom of motor protects it from dirt and rodents.

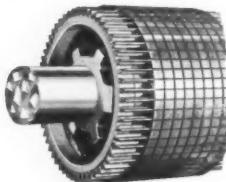
Clean Appearance — Foundation bolts are hidden, machine is clean-looking.



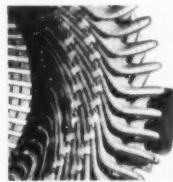
Self-Aligning Capsule-Type Bearings are center seated with single seat. Breather relieves pressure of oil in bearings that could cause leakage.



Precision Construction — Slot sticks are non-hygroscopic trapezoidal, fabric base phenolic. End turns, spaced with polyester glass mat spacer pieces, are laced and tied with flat lubricated glass tubing for long trouble-free life.



Solid Construction — Silver-brazing rotor rods to end ring assures a good joint.



Rigid — End turns of higher speed motors are supported by insulated coil support rings to prevent injurious distortion due to high starting torque and frequent starting.



Timesavers — Separate plates provided to show direction of rotation and magnetic center. Terminal box is amply sized and diagonally split. Leads are brought out through grommet.

For the complete story, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS





The Legal Aspect

MELVIN NORD, P.E.

Consultant in Legal and Technical Problems
Patent Attorney

The Law of Real Property: Location of Surface Boundaries

THE LOCATION of the surface boundaries of land requires the cooperation of a land surveyor and an attorney who understand each other's language.

Monuments

It is perfectly correct to say that the determination of the location of land boundaries is a monumental job. The ultimate means by which the position of land can be defined is by reference to one or more monuments which are supposedly fixed in position on the earth's surface.

Monuments may be classified as natural (e.g., rivers, lakes, cliffs, trees, hills, boulders) or artificial (stakes, fences, sidewalks, curbs, canals). A "record" or "legal" monument is not necessarily an actual mark on the ground but is a reference in a deed to a place on the earth's surface, such as "Blackacre."

Since monuments and marks on the earth are subject to deterioration, destruction, or movement over a period of time, it is necessary to relate the position of one monument to that of others by surveying measurements. Thus, monuments can be reset when necessary.

Two principal methods of relating the position of land with respect to monuments are in general use: (1) metes and bounds descriptions, and (2) subdivision descriptions.

The word "mete" means "measure," and the word "bound" means the "boundary." Thus a "metes and bounds" description may be described by successive courses, each of which is fixed by monuments, directions, or distances. On the other hand, a subdivision description is made by a subdivider or court who files a map or plat in a designated public office, showing the divisions of land and how they are monumented. It generally is required that survey

markers be established on the land before filing the map. The purpose of the map is to avoid complicated written metes and bounds descriptions, while at the same time giving a visual representation of the size and shape of the land. The purpose of filing is to make sure that the map is not tampered with. Another advantage of subdivision maps is that the relation to neighboring land is shown, so that lost monuments can be replaced readily. On the other hand, there are also some disadvantages, since there are generally a number of legal restrictions that must be complied with before the map can be filed, e.g., dedication of streets, installation of improvements, and delay caused by the necessary approval of various governmental departments.

A legal difference also exists between metes and bounds descriptions and subdivision descriptions in that all lots in the subdivision are created simultaneously (on the filing of the map), while in metes and bounds descriptions, the lots are created in successive order. Thus, if there is any excess or deficiency within an entire subdivision, the lots share this proportionally when subdivision descriptions are used; but with metes and bounds descriptions, prior rights are granted to the senior deed — to the lot that was created first.

Interpretation of Descriptions

If there were never any ambiguities or conflicting terms within deeds, there would be no need to say any more about their interpretation, at least insofar as the location of land is concerned. However, to err is human, and to straighten out errors is the job of the law.

The first and foremost rule concerning the interpretation of all deeds is that the boundaries must

be determined by the written terms of the deed and cannot be varied by extraneous (parol) evidence. Where there is some ambiguity in the terminology, this can be cleared up by parol evidence; but parol evidence never can be used to contradict the terms of a deed. Thus "Brown's" lot may be shown to mean a certain particular lot of a certain particular Mr. Brown; but it cannot be shown to mean the southeast quarter of Jackson's farm.

Where the scrivener has erred in the description, however, a court having equity jurisdiction will reform, or correct, the mistake, upon "clear and convincing evidence" that it really was a mistake in the execution of the instrument and not merely a mistake in judgment of the seller or buyer.

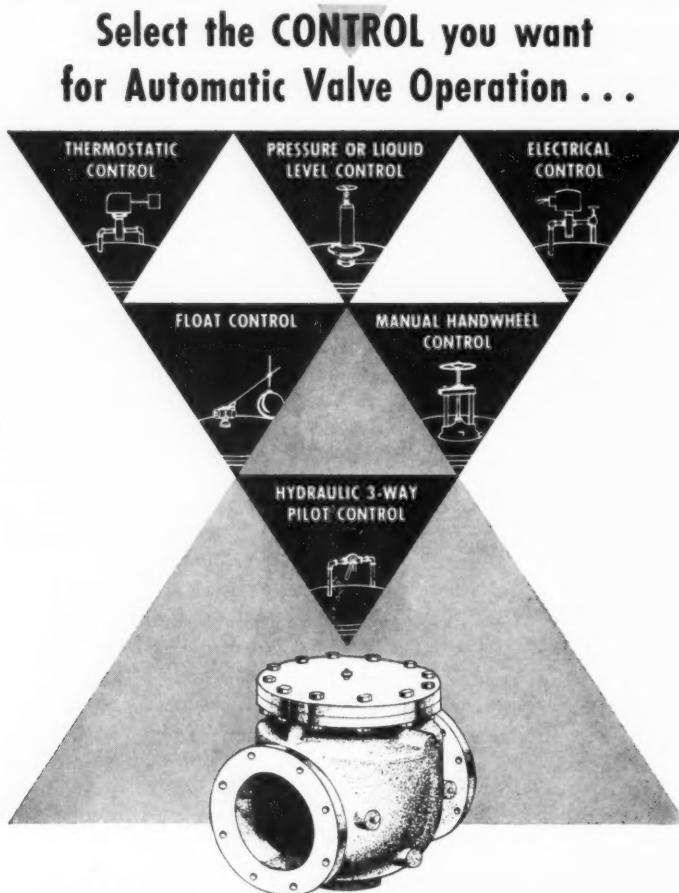
In connection with the "parol evidence rule," there is another rule, involving "incorporation by reference." When a metes and

bounds description calls for a plat or map and the parties acted with reference to it, it becomes incorporated within the deed by reference in the same way as if it were actually in the deed itself. This is so regardless of whether or not the map has been recorded, so long as the map referred to is clearly identified. There is always a legal presumption that when a map is called for, the parties acted with reference to it. This presumption is rebuttable by the introduction of evidence to the contrary; but in the absence of such evidence it stands.

Priority of Grants

There is another important principle of deeds. When a junior grant conflicts with a senior grant, the senior grant has priority. In other words if A has sold Blackacre (or a portion of it) to B on Jan. 2, and has sold it again to C on Feb. 2, B is the owner and not C. There are, however, some very important limitations on this rule. The most important of these, for our purposes, grows out of the statutes requiring the recording of deeds in specified public offices. If a senior deed is not properly recorded, a junior purchaser who has paid value and taken possession without notice of the senior grant has priority. (In some states, he gets this priority only if he actually records his deed before the senior deed is recorded.)

The paramount rule of interpretation of deeds, in the event of conflicting terms, is that the meaning is determined by the intention of the parties to the deed. However, since the parties are rarely so gentlemanly as to let us in on the secret of their intentions (since they are the ones who have caused all the confusion in the first place), we usually are forced to fall back on legal presumptions. These presumptions are rebuttable; but in the absence of evidence to the contrary, they stand. In addition, there are a number of general maxims which are of more or less use to judges in



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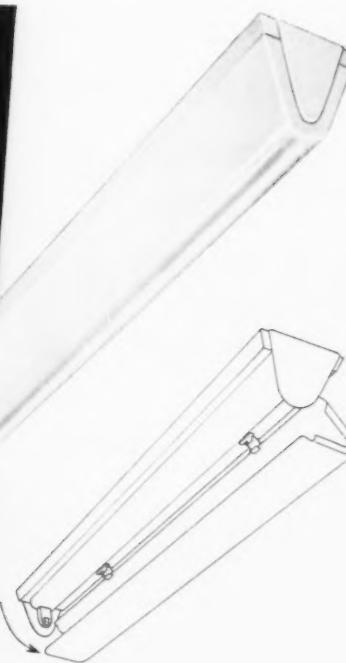
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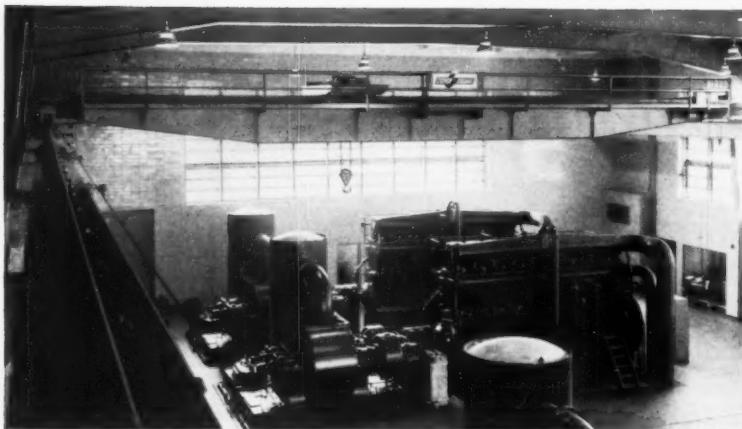
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| New London: United Elec. Sup. Co. | Kinston: Kinston Elec. |
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| Hyland Elec. Sup. Co. | OKLAHOMA Tulsa: Lawson Elec. Co. |
| Wholesale Elec. Sup. | PENNSYLVANIA Allentown: Coleman Elec. Co. |
| Elgin: Fox Elec. Sup. | Erie: Kraut Elec. Co. |
| Rockford: Englewood Elec. Sup. Co. | Harrisburg: Fluorescent Sup. Co. |
| Springfield: Springfield Elec. Sup. | Hazleton: Power Elec. Co. Inc. |
| INDIANA Ft. Wayne: Mossman-Yarnelle Co. | New Castle: Midwestern Elec. Co. |
| Gary: Englewood Elec. Sup. Co. | Philadelphia: Ace Lighting Fix. Co. |
| So. Bend: Englewood Elec. Sup. Co. | Gold Seal Elec. Sup. Co. |
| IOWA Des Moines: Weston Lighting Co. | Sylvan Elec. Fix. Co. |
| KANSAS Kansas City: W. T. Foley Elec. Co. | Pittsburgh: Allied Elec. Sup. Co. |
| KENTUCKY Paducah: Ohio Valley Sup. | Argo-Lite Studios |
| LOUISIANA Baton Rouge: Electrical Wholesalers | Doubleday-Hill Elec. Co. |
| New Orleans: Interstate Elec. Co. | Wally Elec. Sup. Co. |
| MAINE Bangor: Standard Elec. Co. | Reading: Coleman Elec. Co. |
| MARYLAND Baltimore: Atlanta Illuminating Co. | Scranton: Lewis & Reif |
| MASSACHUSETTS Boston: Mass. Gas & Elec. Light Co. | Wilkes-Barre: Anthracite Elec. Sup. Co. |
| Henry L. Wolfers Inc. | RHODE ISLAND Pawtucket: Major Elec. Sup. Co. |
| Fitchburg: Service Elec. Sup. Co. | Providence: Leavitt Colson Co. |
| Pittsfield: Carr Supply | SOUTH CAROLINA Anderson: Sullivan Hdwe. Co. |
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| Worcester: Atlantic Elec. Sup. | Noland Co. |
| Benjamin Elec. Sup. | Greenville: Sullivan Hdwe. Co. |
| MICHIGAN Detroit: Madison Elec. Co. | SOUTH DAKOTA Wheaton: J. H. Larson Elec. Co. |
| Michigan Chandelier Co. | TENNESSEE Johnson City: Noland Co. |
| Flint: Royalite Co. | Nashville: Nashville Elec. Sup. Co. |
| Grand Rapids: Purchase Elec. Sup. Co. | TEXAS Dallas: Rogers Elec. Sup. |
| Pontiac: Standard Elec. Co. | Ft. Worth: Anderson Fixture Co. |
| Pontiac: Standard Elec. Co. | Houston: Martin Associates |
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| Minneapolis: Charles A. Anderson & Co. | VERMONT Lyndon: Mid State Elec. Sup. Inc. |
| Northland Elec. Sup. Co. | Montpelier: Noland Co. |
| St. Paul: Lax Elec. Co. | WEST VIRGINIA Charleston: Goldfarb Elec. Sup. Co. |
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| Binghamton: Freije Elec. Sup. Co. | WASHINGTON Seattle: Seattle Lighting Fix. Co. |
| Buffalo: Buffalo Incan. Light Co. Inc. | Alaska—Anchorage: Northern Supply Co. |
| Niagara Falls: Hysen Sup. Co. | CANADA Montreal: The Gray Elec. Co. |
| | Toronto: Revere Elec. Dist. |
| | Toronto Elec. Sup. Co. |
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**WORM AND GEAR DESIGN
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CONCO "CRB" OVERHEAD ELECTRIC TRAVELING CRANE installed in municipal sewage disposal plant.

A feature of this Conco "CR" series crane is a worm and gear mechanical load brake which provides maximum safety, lower first cost, and the elimination of any adjustment or service needs. The brake offers a virtually limitless service life. It has only 2 moving parts. Conco "CR" cranes are one of many types custom-built for all classes of service. To engineers Conco offers two important facilities: A plant flexibility that permits true custom-building at a practical cost. And, a staff qualified by 50 years experience to provide such design assistance as you may request. May we submit specification data, an estimate, or a proposal on your next crane requirement? Write for Bulletin 5000A.

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See Our Catalog: Sweet's Industrial Construction File

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making their decisions sound more plausible than they really are. Thus, it is said that: "particular expressions qualify general expressions;" "an interpretation which gives legal effect to an instrument is preferred over one which would make it void;" "the terms of a writing are presumed to have been used in their ordinary sense unless shown to be used in some special or local sense;" and "a deed speaks as of the date of its execution." While these maxims cannot honestly be said to be very helpful, it must be admitted that they cannot do much harm either.

Lines Can Show Intent

A rule of real significance is the one stating that despite an ambiguity in a deed, if the parties have actually located and marked lines on the ground at the time of the transaction, this is presumptively an accurate indication of their intention. However, this rule cannot be applied if the lines in question encroach on a senior right.

When there is a conflict between an identifiable undisturbed monument called for in a deed, and a measurement of distance, angle, or area, the monument is presumed to control.

There are a number of presumptions relating to conflicting monuments. Natural physical monuments control over artificial monuments, record monuments, and meander lines; artificial monuments control over record monuments; where two otherwise equal monuments conflict, the one in harmony with distance and angle controls.

Some other useful presumptions are: distance and bearing are presumed to be superior to surface; area is presumed subordinate to other elements; a grant is construed in favor of the grantee (unless the grantor is a public body); where two terms conflict and there is nothing else to decide which controls, the one first stated controls; where words and figures disagree, the words control.



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Telephone



manufacturer calls for coal

Automatic Electric Co. burns coal in new plant because of cost and availability

Modern facilities, modern products, modern fuel—you'll find all three at the new Northlake, Ill., plant of Automatic Electric Co., manufacturing subsidiary of General Telephone. The power house of this communications equipment plant (designed and built by The Austin Company of Cleveland) is as modern and efficient as the manufacturing process itself. The plant required large quantities of economically and reliably produced steam for process work and heating. The fuel selected was **coal**, because of coal's economy and abundant supply. As a result, today Automatic Electric enjoys dependable, low-cost steam.

Facts you should know about coal

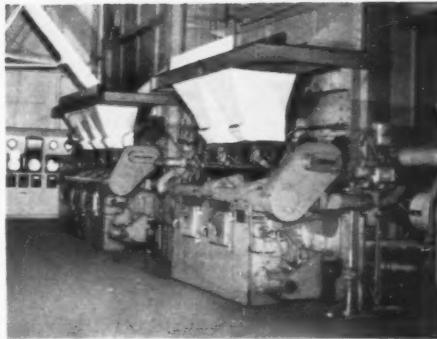
You'll find that bituminous coal is not only the lowest-cost fuel in most industrial areas, as in the case of Automatic Electric, but up-to-date coal burning equipment can give you 15% to 50% more steam per dollar. Today's automatic equipment can pare labor costs and eliminate smoke problems. And vast coal reserves plus mechanized production methods mean a constantly plentiful supply of coal at stable prices.

Technical advisory service

All companies planning a new power plant, or the remodeling of a present one, should consult an engineering firm on its design and construction, as Automatic Electric consulted The Austin Company. As a matter of fact, every Bituminous Coal Institute advertisement advises its readers to take this step. When you have such a project, our Engineering Staff will be glad to assist you in your fuel cost survey with any coal information you may require.

Meanwhile, we believe you will be interested in our informative case history booklet, complete with data sheets. Send coupon on the right for your copy.

Shown are two of the three Keeler boilers — fired by Detroit Spreader Stokers — in the power plant. At the right is the 22,000 lb/hr boiler. In the background is one of the 50,000 lb/hr boilers. The two sizes allow flexibility in operation for widely varying load requirements.



Control panel by Hays Corporation. This system regulates all operations of the boilers—steam pressure, draft, flue gas temperature, banking periods, etc.—to give complete, automatic control of steam generating operation.



Ash disposal system, by United Conveyor Co., in basement of boiler room. Ash is removed from furnace by Detroit CC grate, drops into hoppers in basement and is taken by vacuum to silo.



The Bituminous Coal Institute now has available a free booklet adaptable for design loads 3,000 to 24,000 EDR steam. This booklet, "Guide Specifications for Typical Low-Pressure Commercial Heating Plant," contains specifications, drawings and tables on all aspects of a typical heating plant. Send in this coupon for your copy.

Guide Specifications Booklet Case histories on larger plants.

BITUMINOUS COAL INSTITUTE

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The Word from Washington

EDGAR A. POE
Consulting Engineer Correspondent



CONSULTING engineers, who long have felt a marked discrimination against them in the tax laws relative to financing retirement plans, are looking hopefully to Congress.

Perhaps nearly every member of Congress has received appeals to eliminate the discrimination (at this session) by passage of the Jenkins-Keogh bill. Under present laws, the head of an engineering firm, or any small professional or business man, can establish an employee pension plan out of earnings before taxes. However, when he makes a retirement provision for himself he has to pay for it out of taxed dollars.

Many thousands of words of pertinent testimony by competent witnesses, who appealed for passage of legislation designed to encourage individuals to set up voluntary pension plans, are now a part of the 1958 record of the House Ways and Means Committee. Only time will determine the ultimate fate of the proposed measure.

CONGRESS has before it a report by Interior Department specialists who express hope that sea water can be desalinated at low conversion costs within the next 10 years or so. Interior's Office of Saline Water, in a statement to the House Appropriations Committee, said if further research is successful salt water may be converted into fresh water by several processes for less than 50 cents per 1000 gallons, and brackish water for less than 25 cents. Current conversion by distillation processes is estimated to cost from \$1 to \$3 per 1000 gallons.

After years of research the Office of Saline Water has put two much improved processes under pilot test operation on Harbor Island, N.C., and another plant is being built in Florida. The three processes being researched by the Federal Government are:

- ¶ Hickman low pressure, low temperature, revolving still distillation.

- ¶ Long tube boiler distillation.

- ¶ Solar distillation.

David S. Jenkins, director of the Office of Saline

Water research program, says in testimony before the Appropriations Committee that the office has not yet had money nor time enough to advance any single process through to the completion stage. He maintains that it is essential that several different kinds of processes be developed to meet all foreseeable needs.

MANY engineering problems lie ahead. This appears obvious in the Nation's Capital. Census Bureau experts now are predicting a population increase of 60 million people to 231 million in the United States by 1975. Not too long ago the experts were forecasting that the increase would be to 200 million. Census Bureau spokesmen point out that this increase means that more fresh water, electric power, homes, schools, streets, highways, shopping centers, and recreational areas must be supplied.

THE Supreme Court is going to pass on the question of whether or not the National Labor Relations Board has the right to include employees of nonprofessional status in a professional voting unit without consent of the professionals. The issue to be placed before the tribunal will be whether the courts have authority to pass upon the validity of NLRB rulings. It is maintained by the Government that the courts are powerless to review the decisions. It probably will be several months before oral arguments will be heard and a ruling issued. The Supreme Court granted the National Society of Professional Engineers the right to file a "friend of the court" brief in connection with the case.

THE Navy's Bureau of Ships is off to a successful start with its trail-blazing program in an effort to attract engineers and scientists. The Bureau, through competitive examinations, is selecting 500 outstanding high school seniors and sending them to college for five years at no cost to the students. This will cost the Federal Government \$302,000 a year. The graduates will launch their govern-



NEW USE FOR GRATING -- SUN SHADES FOR MODERN SCHOOLS

Light aluminum grating for SUN SHADES on schools is in perfect harmony with modern school design — allows 80% passage of light and air without the accompanying penetrating rays of the sun. Because they are aluminum they are maintenance-free. Furthermore, they provide a permanent working platform for easy access to windows. Only the finest precision manufacturing would satisfy the architect who designed the school shown here. BORDEN is recognized as a leader in quality custom-manufactured gratings, in ferrous and non-ferrous metals. Other uses for grating in school design: Areaways, boiler rooms, laboratories, gridiron catwalks in auditoriums and gymnasiums, footscrapers and window guards.

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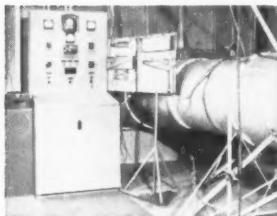
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mental careers at a grade 7 starting salary, and are obligated to stay with the Bureau for 18 months.

THE National Society of Professional Engineers takes the position that any action to subsidize the supply of engineers is not good, because engineering enrollments are already at an all-time high with indications that they will further increase in the future. The Society further contends that the emphasis should be on improving the quality of future engineers.

PRESIDENT Eisenhower recommended to Congress a budget of \$198 million for the Bureau of Reclamation for the 1959 fiscal year starting July 1. The amount compares with about \$180 million of new funds, most of it for construction contracts, for the current fiscal year. The Bureau of Reclamation, operating in the 17 arid and semiarid Western States, primarily is concerned with development of water and land resources. It has under construction projects with an estimated total cost of \$3.7 billion. During the past 15 years these states have been outgrowing the rest of the country in both population and in industry.

W. A. Dexheimer, commissioner of the Bureau of Reclamation, reports that the Bureau is continually examining its administrative procedures to make better utilization of the engineers. The commissioner says the young engineers are receiving intensive training and orientation in various phases of work. He added that the Bureau is developing engineers of wider experience and sounder judgment, and engineers "who will take pride in a career of creating lasting water developments."

During the winter season when construction normally is curtailed, the engineers go through a three weeks' course in earth and concrete control procedures and methods and other improved construction practices, as well as developments in new materials. Some of the top contractors of the country attend the conferences.

PEARING before the Senate committee on labor and public welfare, G. E. Arnold, chairman of the Engineering Manpower Commission, said the solution to America's immediate manpower problem calls for a higher quality of trained technical people. And the long-range program calls for additional numbers.

"The development of the guided missile does not require a thousand engineers," Arnold explained. "The job could be done by four highly qualified engineers assisted by others on the detail work."

"We feel," Arnold continued, "that the work of this committee or the legislation which comes out of this activity should perhaps be pointed toward

TO SERVE YOUR CLIENTS BETTER INCLUDE CATERPILLAR DIESEL ELECTRIC EMERGENCY POWER IN THEIR DESIGNS

When regular power failed recently in New York's fabulous Grand Central Station, leaving rush-hour commuters to fumble their way to trains with the aid of lanterns and candles, it dramatically pointed up the need for emergency power sources. Less dramatic but often more costly power failures occur daily throughout the nation. More and more, responsible architects, serving industry and government, are safeguarding

their clients' best interests by taking into consideration the need for emergency power units when it counts—*before a structure is built.*

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Mountain States Telephone & Telegraph Co., Denver, Colorado

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WMRC, Inc. (WFBC-TV)
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KGO-A.B.-P.T., Inc.
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Canadian Joint Staff Building
Washington, D.C.
Miami Beach Federal Savings & Loan
Association, Miami Beach, Florida
First National Bank
Fort Lauderdale, Florida

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Haledon Hatchery, Paterson, New Jersey
Nichols Hatchery, Monmouth, Illinois
East Point Hatchery, Inc., Elkton, Virginia

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Escanaba, Michigan
Philadelphia Electric Company
Philadelphia, Pennsylvania

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Capital Airport, Springfield, Illinois
Washington National Airport
Washington, D.C.

MILITARY GROUND SUPPORT

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Cape Canaveral Missile Test Center
Florida
Strategic Air Command

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Suburban Hotel System
Summit, New Jersey
State Line Hotel, Inc., Wendover, Utah
Cactus Pete's, Inc., Contact, Nevada

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Wizard Falls Trout Hatchery
Camp Sherman, Oregon
Made Rite Bakery, Goldsboro, North Carolina
Abilene Laundry Co., Abilene, Texas
Dade County Civil Defense
Miami, Florida
National Park Service
U. S. Dept. of Interior
Yellowstone Park, Wyoming
Food Fair Stores, Miami, Florida
Valle's Steak House, Kittery, Maine
Ak-Sar-Ben Race Track
Omaha, Nebraska
Hialeah Race Track, Hialeah, Florida

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more and better graduate work in order to produce that small nucleus of highly trained and highly qualified men who can conceive and develop the important things that are needed in future technological advancement, not only in national defense but also in the general economy... What we need is quality, not quantity."

IN a report to the Senate, American Road Builders Association representatives stated that the highway industry is ready and able to complete construction of the interstate roads before 1970. Julian R. Steelman, ARBA president, said the "tooling-up" period, spent in route location, advance engineering, and acquiring rights-of-way virtually is over and the construction phase is set to go.

J. N. Robertson, past ARBA president, added that ARBA findings of 1956 that highway engineering could support a \$10-billion program in 1959 now is revised to \$11 billion. Reporting on progress, Robertson added that "the services of consulting engineers have been very satisfactory in the many states where their services have been utilized in the design of the Interstate System."

LATIN America's demand for electric power is expected to continue at a brisk pace for years to come. One example of the growth is the state of San Paulo in Brazil. The World Bank has made a loan of \$13.4 million to aid in financing an 85,000-kilowatt power project on the Paranapanema River. This project includes a 179-ft high dam.

Meanwhile, President Henry B. Sargent, of the American and Foreign Power System serving 11 Latin American countries, said construction activities of the system are expected to exceed the \$84 million spent in 1957 for improvement and expansion. During the next five years the Foreign Power System expects to spend about \$500 million on construction.

A PLAN which would require the registration and reporting of employee welfare and pension benefit plans is expected to come out of committee in the Senate at any time.

Senate Bill 2888 would require all welfare and pension plans to be registered within 90 days after they are begun. For each plan covering more than 100 employees, the bill requires an annual report of the amount contributed by employees and employers, benefits paid, salaries and fees charged to the plan, the amount of commission and fees paid for insured benefits, and investment details. Copies of the reports filed with the Secretary of Labor also would have to be made available upon request to any employee or other participant or beneficiary of the proposed plan. ▲▲

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YARWAY

BLACK & VEATCH, consulting engineers, established a modern data storage system coincident with their relocation last year to new quarters on the outskirts of Kansas City. This system is applied both to the voluminous data on current projects as well as to older projects, some of which have been inactive for 10 or 20 years. Since much of the firm's work consists of client repeat assignments, ready reference to drawings for all these dated projects is important.

Because of its simplicity, this data storage system has application in other consultant firms faced with the problem of storage of reports, drawings, correspondence, and various other sources of general client information which may prove to be of value at some future date.

CE exclusive

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Storage

The storage area is located in the air conditioned basement of the new two-story building and occupies 2360 square feet. Six hundred square feet of this area are used for storing tracings of completed projects. These tracings are filed alphabetically in metal shelving located in a room at one end of the storage area enclosed with a fire wall and fire door. In the other portion of the storage space, all design calculations or other pertinent data, together with correspondence on the project and a copy of the specifications, are bound and filed on



TOP PHOTO SHOWS THE NEW 37,500-SQ FT OFFICE HEADQUARTERS OF BLACK & VEATCH. AT LEFT, A DESIGNER USES OFFICE INTERCOM TO ORDER A DATA FILE FROM STORAGE.



FILE CLERK NOTES THE PROJECT NAME AND NUMBER, CHECKS THE SHELF LOCATION OF ITEM FROM CARD INDEX, AND THEN REMOVES FOLDER, REPLACING IT WITH "OUT CARD."

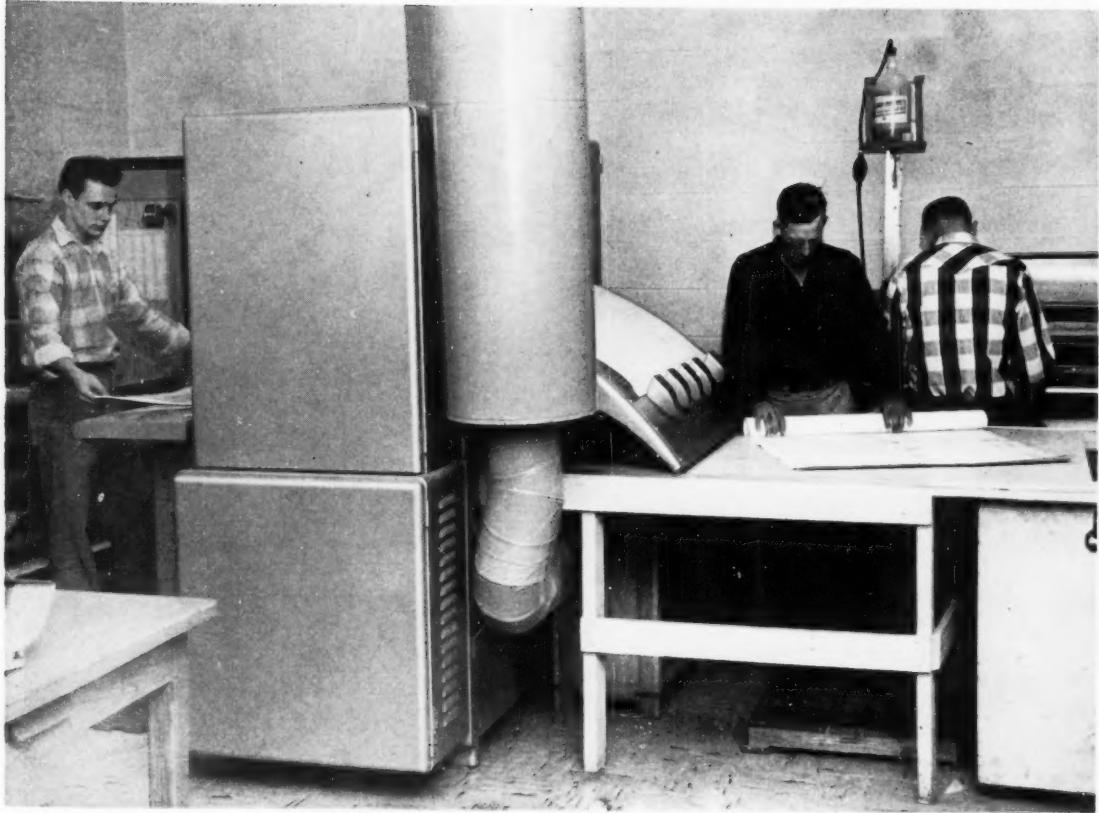
metal shelving. The project number, assigned at the initiation of the particular project, the client, and the client's address are printed on the outside of each package. The shelf number also is listed. A card index for all stored data is kept up-to-date. Each card includes the project name and number, and shelf number.

When someone wishes information concerning a particular project, he calls the file clerk, giving the applicable project name and number. The file clerk then determines the shelf location of the project from the card file, removes the data, and delivers it. At the time the data is removed, an 8½ x 11 in. "Out Card" is put in its place. This card records the date of removal of the data and the name of the person to whom the material has been assigned.

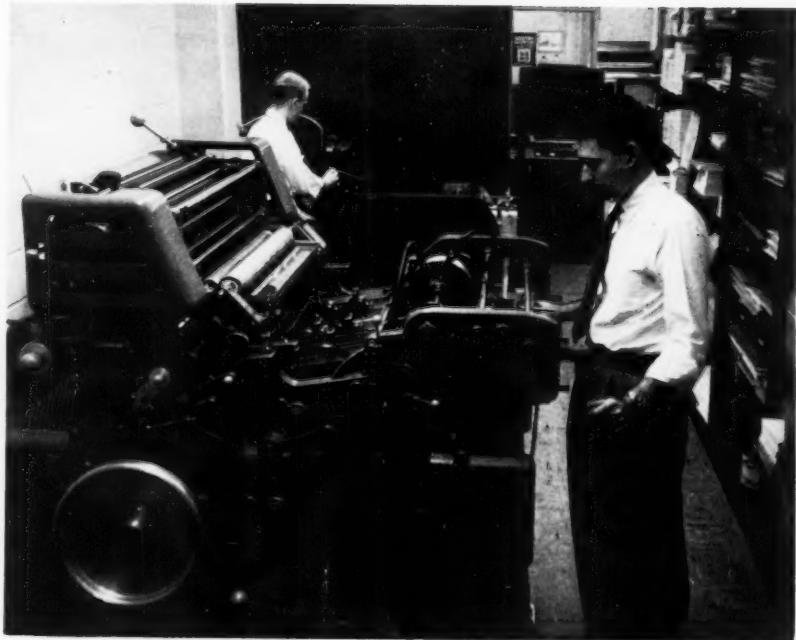


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Black & Veatch also maintains a complete reproduction department, occupying about 1250 square feet. It has in it two 42-in. ammonia process printing machines, two offset printing machines, and two mimeograph machines. The ammonia process printers produce practically all the construction plans for the firm as well as all other prints from tracings. The offset printing machines are used for special reports, and for the printing of the various forms required for the general operation of the office. The mimeograph machines produce reports, specifications, inventories, and rate studies. Other miscellaneous reproduction equipment including a vacuum printer (for making offset plates), paper cutters, an electric paper drill, automatic photocopy machines, and a foot stapler. This combination of equipment makes it unnecessary for Black & Veatch to go to outside printers for any but the most complicated and exacting jobs.



FINAL STEP IN SPECIFICATION PRODUCTION:
BINDING WITH A HEAVY-DUTY FOOT STAPLER.



CITY, UTILITY, AND DEFENSE OFFICIALS TEST THE NEW CIVIL DEFENSE CENTER IN PORTLAND, OREGON.

Designing an Underground Building

RALPH S. TORGERSON

WHILE ADEQUATE civil defense has a long way to go to become a reality in most parts of the United States, a few localities have started planning for area evacuation, emergency and disaster aid, and shelters for vital services.

C_E exclusive Shelters, especially those designed to house essential government organizations during an attack, are an interesting challenge to consulting engineers. Planning these shelters is much like planning a city. A number of people will have to live in the shelter, perhaps for prolonged periods. They require air, food, heat, light, sanitation — all the essentials.

In addition, the shelter must withstand heavy bombardment and, if possible, be concealed or camouflaged. And since any attack is likely to encompass the use of nuclear weapons, the shelter should have its own air and water supplies.

Portland, Oregon has just completed an underground operations center with design characteristics that can serve as a guide for this type of structure in other parts of the country. The building was designed by Edmundson and Kochendoerfer, Architects, with R. Evans Kennedy as consulting engineer in charge of the project.

The underground operations center will serve as the emergency seat of Portland city government in case of disaster or attack, and for direction of rehabilitation for the entire metropolitan area. Since its completion, the center has drawn visitors concerned with civil defense from all parts of the country and abroad, and has served as a guide for similar projects in several other cities, including Salt Lake City, Phoenix, Tampa, and Boston.

The operations center can house 300 people for 10 days under emergency conditions. Facilities have



A RADIO BROADCASTING TOWER ABOVE ENTRANCE TO UNDERGROUND OPERATIONS CENTER IN PORTLAND.

been provided for the direction of police, fire, engineering, medical, welfare, warden, and headquarter departments plus available space for liaison with state and county authorities, the press, and the military services.

An all-electric kitchen can prepare food for 300 people. A dining area seats 50 persons. Personnel on duty will be fed in shifts on a continuous basis. A large supply of dried foods will be kept in the building. An independent water supply is available from a well beneath the structure.

Construction

The structure is a two-hinged reinforced-concrete arch over 2-ft thick. It has a span of 95 feet and is 140-ft long. The second floor — a concrete slab on steel framing — is 85-ft long. The extra 55 feet of length is taken up by the large operations room. An entrance structure houses the fan room and personnel decontamination and security equipment.

A great deal of planning was required to get the desired facilities under the concrete arch. Several possible positions on the site were studied. Foun-

dation analyses were made to assure sufficient soil-bearing capacity for an arch of this type, since extremely high reactions occur under each foundation wall. The building was finally placed in a draw on the side of a hill, on sandy gravel with some clay intermixed. After clearing and excavation, the structure was built in position, backfilled over the top, and contours adjusted to produce the desired loading on the arch.

To determine arch loadings during backfilling, strain gages were placed at two points in the arch and one point in the arch tie. These gages controlled backfilling operations on top, and later checked stresses as the overburden settled the arch into its permanent position. Some deflection of the arch was expected as the overburden was replaced, but strains gradually decreased until at the end of 90 days of loading they were virtually undetectable.

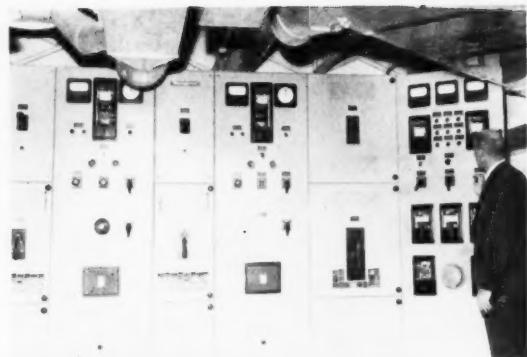
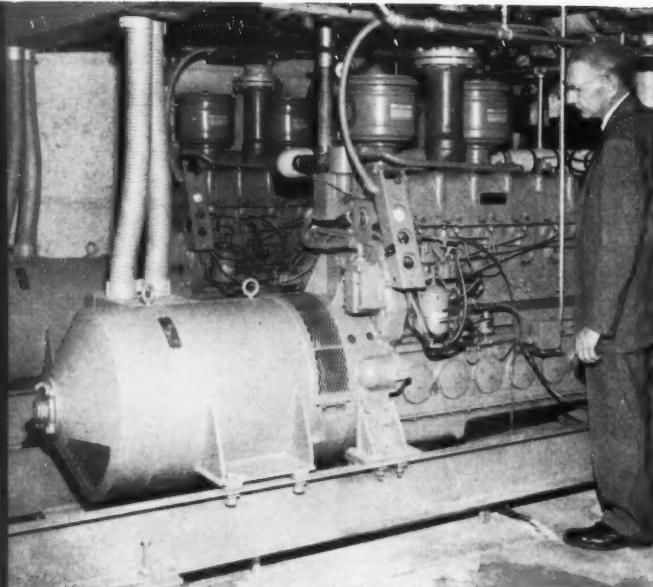
The shape of the arch is such that pure thrust was produced along the arch itself in the final loading condition. The radius and the elevation of the top of the arch were adjusted until this condition was achieved. Arch shape and the loading diagram were correlated carefully so the final condition produced compression with little bending in the shell itself.

Shell Construction

For protection against penetration as well as for economical forming, a uniform-thickness shell was used. It was formed on prefabricated wood trusses supported on jacks of sand. These three-hinged, plate-connected trusses supported joists which were covered by sheathing. The sheathing was, in turn, covered by a cement-impregnated wood fiber laid



THIS IS THE WAY UNDERGROUND STRUCTURE LOOKED BEFORE BACKFILLING OVER HINGED ARCH ROOF.



CIVIL DEFENSE CENTER HAS CENTRAL CONTROL PANEL SO STANDBY POWER SWITCHES IN AUTOMATICALLY.

STANDBY POWER IS PROVIDED BY TWO, 6-CYLINDER DIESEL ENGINES DIRECT-CONNECTED TO GENERATORS.

on the truss sheathing in 4- by 8-ft panels. When the edges were sealed, this was followed by reinforcing steel and concrete. The wood fiber lining has good sound-deadening properties. The concrete was poured on one side of the arch, then the other, gradually building to the top.

After the concrete had set sufficiently to support its own weight, the trusses were lowered by drawing the sand out from underneath the truss support points and letting them down to rest on wheels which rolled on steel angles. The truss form work then was pulled to the next pouring position, jacked up to its true alignment, and again supported on sand jacks.

Alignment at the arch top was maintained within one inch by careful truss positioning. The top of the arch was placed slightly above its final position, the weight of the wet concrete producing the expected deflection to bring the crown down to the desired elevation at the end of the pour.

Ventilation System

Since the Portland operations center will house a large number of people, a fresh air supply is vitally important. Thomas E. Taylor, mechanical engineer, designed a system in which air is drawn into the building through a shaft extending a short distance above the ground. The shaft openings are protected. This outside air can be distributed through two different systems. One, used when the air is not contaminated, routes the air through standard dust filters, across cooling or heating coils, and then distributes it throughout the building in ducts. The other system, used if the air is suspected of being contaminated, shunts the air through combination chemical, biological, and radiological filters, which

remove radioactive particles. These filters are procured from the Army Chemical Corps. Ventilation system capacity is 5000 cfm, well over anticipated requirements for this building.

If outside air cannot be used, the entire building can be sealed off and all air recirculated. Then used air is passed through activated-carbon filters, oxygen added, and the air cooled and redistributed. Recirculated air can be mixed with outside air in any desired ratio, so very small amounts of outside air may be added to improve the quality of the recirculated inside air. As the building is under pressure, all air leakage is outward, preventing infiltration of contaminated air. An airlock system at the entrance permits operation of the doors.

Control of Zones

For ventilation purposes, the entire structure is divided into three zones. Zone 1 is the space used from day to day. Zones 2 and 3 are for the remainder of the space devoted to emergency use. Zone 1 ventilation demand is light in comparison to total requirements. Under emergency conditions, when 300 people use the entire building, the ventilation load becomes very heavy. Changing from Zone 1 to Zone 2 and 3 is accomplished by adjusting a few switches. These actuate control valves, and fans produce the revised ventilation requirements.

Very little heat loss is anticipated since the building is underground, therefore the heat load is relatively light. When the occupancy is relatively low and when the outside air is cold, some heat will be necessary for comfort. Two sources supply heat. An electric furnace takes care of the low requirements, and when more heat is needed, one of the standby generators automatically starts, and heat is obtained

from the generator's cooling system. When demand falls back to the capacity of the electric furnace, the generator automatically shuts off.

A great deal of attention was given to the standby power facilities designed by Fritz Klawa, electrical engineer. Normal requirements are provided by the local power company. Stepdown transformers are housed in an inside vault. In the event of an outside power failure, a control panel automatically starts the standby power plants and synchronizes them before switching over the power load. The standby units are two, 100-kw generators, each powered by a 6-cylinder diesel engine. Each generator has been tested at 20 percent overload for two hours. These standby generators automatically start when the load exceeds 90 kw.

Under ordinary operating conditions, outside power is sufficient. Under emergency conditions, or when all lights and all ventilation units are in full service, the standby units start, and outside electricity is cut off. When the inside load drops below 90 kw the generators automatically shut off after 15 minutes and outside power, if available, is used.

Communication and Security

One feature of the building is the security system designed to identify anyone entering the building. Electric eyes warn of approaching persons. After a person is through the entrance door, he passes a closed-circuit television camera. Before he can open

the interior front door, he holds up an identification card to the camera. Television screens in the police radio dispatch office and at the reception desk inside the building show the card and person. If he is properly identified, the interior front door is unlocked electrically.

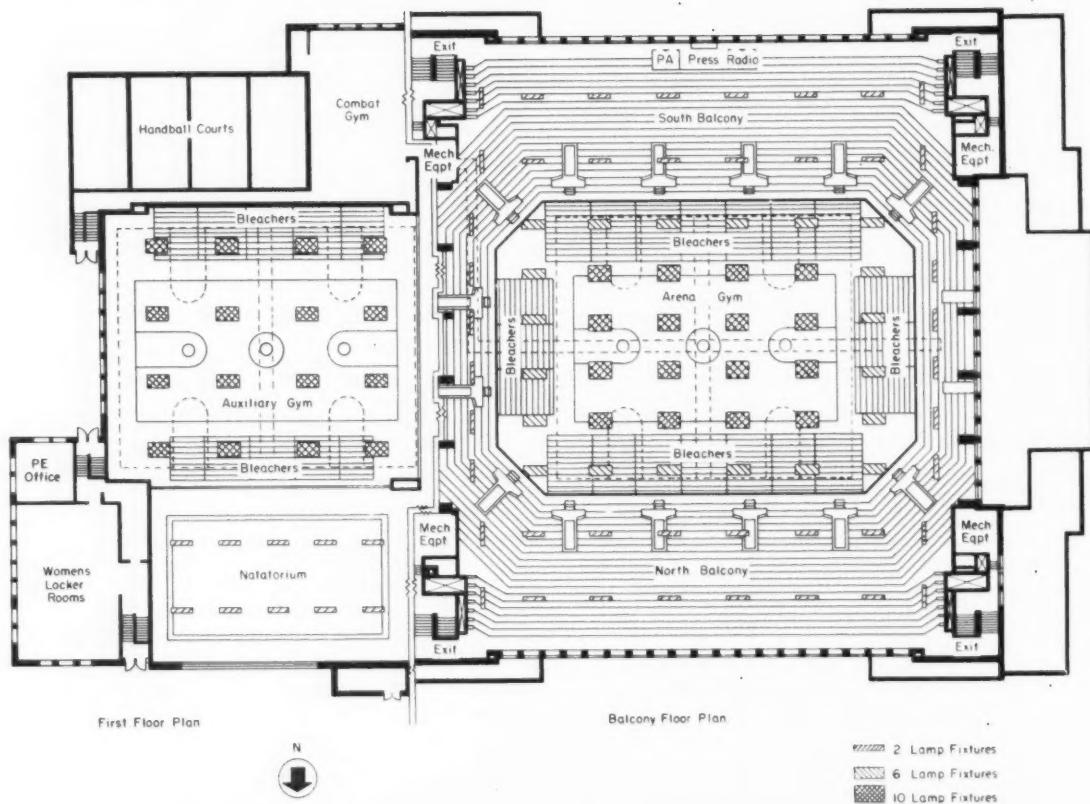
More than 200 telephone lines have been brought into the building. At present all are tied to one central office exchange. No switchboard is used; all telephones are on private lines. Over 100 telephones are required but for the moment only 25 are connected. The telephone company is prepared to connect the other 75 phones on short notice. In addition, a telephone communications center has 20 telephones manned by operators. Two telephone numbers cover these 20 phones.

Since telephone facilities may be completely destroyed by an attack, standby 60-watt radio transmitters can be operated from the operations center on the seven FM radio frequencies used by Portland municipal departments. In addition, there will be available two or three amateur frequencies plus standby transmitters to be installed and operated by the Civil Air Patrol, the local utilities, and possibly one or two taxicab companies. It has been necessary to add more radio equipment for fire, police, public works, park bureau, traffic engineering, public health, and other city services having assigned civil defense responsibilities during an emergency requiring radio communications. □ □



DETAIL PHOTOGRAPH OF REINFORCED CONCRETE ARCH FORMING ROOF OF THE UNDERGROUND VAULT.

THE NEW JOHNSON GYMNASIUM AT UNIVERSITY OF NEW MEXICO SEATS 8000. COST \$2 MILLION.



FLOOR PLAN SHOWS HIGH-BAY LIGHTING FOR SWIMMING POOL AND MAIN AND AUXILIARY GYMS.



CARL R. ALBACH
Consulting Electrical Engineer

Carl Albach has been interested in lighting since his days at Rensselaer Polytechnic Institute. His graduation (1928) thesis was on lighting a silk mill. After Rensselaer, Albach was with the New York Telephone Company, the Army Engineers, Western Electric, the W. C. Kruger Company, and the University of Buffalo (M.A., 1939). He opened his own office in Santa Fe in 1950. Albach is a member of AIEE and IES. He is a charter member and past chairman of the IES New Mexico chapter, past vice chairman of the fourth Intermountain IES regional conference, past vice chairman of the state board of professional engineers, charter member and first president of the Consulting Engineers Association of New Mexico, and a director of the Consulting Engineers Council.

My Approach to High Frequency Lighting

A FEW YEARS AGO it was found that if the wattage of a standard, 96-in., T12 Slimline lamp was increased from its usual 60-cycle value of 74 watts to as high as 110 watts, and at the same time the frequency was increased to 400, 3000, or even 20,000 cycles, the lumen or light output showed a 4 to 147 percent increase. If this information had been available 50 years ago when 60-cycle current was chosen as a compromise between the 25 and 133 cycles then in general use, a higher frequency might have been adopted.

Frequency converters are commercially available for the 400-cycle level, and this higher frequency provides a new approach for consulting engineers working on projects involving high-bay illumination of large areas.

Early High-Frequency Installations

The first project of this type was at the Union College field house, Schenectady, N.Y. It was the inspiration for my design of a 400-cycle, 600-volt, high-bay lighting installation in the new Johnson gymnasium at the University of New Mexico. When my design work started in the fall of 1955, the Union College installation was the only one on which information was available. Later we learned that the Camden, N.J. convention hall had been relighted using 400 cycles with 16-lamp fixtures, and that the new Vermillion, Ohio office building of the Wakefield Company had installed an 840-

cycle lighting system. The UNM gym installation, however, is believed to be the first 400-cycle gymnasium lighting project using 2-, 6-, and 10-lamp fixtures with remote-control switching to provide 5, 10, 30, and 50 foot-candles of illumination in the main arena area.

Improved Efficiencies

The reason for specifying a 400-cycle system is to improve the efficiency. If a standard, 8-ft Slimline lamp is operated at 600 volts and 400 cycles instead of at the conventional 120 volts and 60 cycles, light output is increased from 4900 to 6000 lumens — about 22 percent. Five, 8-ft Slimline lamps operated at 60 cycles produce 24,500 lumens and consume 370 watts, while four of the same lamps operated at 400 cycles will produce 24,000 lumens and consume 360 watts.

To compare light output another way, a 1500-watt incandescent lamp, perhaps the most efficient of the general incandescent lamps, produces 22 lumens per watt; a 400-watt mercury vapor lamp produces 50 lumens per watt; a 96-in., T12 Slimline lamp operated at 400 cycles produces 66 lumens per watt.

In a high-bay area (at the UNM gym the fixtures are hung at heights between 39 and 42 feet) cleaning and relamping can be a problem. Since maintenance men are seldom as tall as basketball players, one either has to get the man up to the fixtures or the fixtures down to the man. The latter has its



A 30-FOOT-CANDLE LIGHTING LEVEL FOR PRACTICE SESSIONS COMES FROM 6 LAMPS IN ALI. FIXTURES.



ALL LAMPS ARE TURNED ON FOR GAMES, GIVING 50-FOOT-CANDLE ILLUMINATION ON MAIN COURT.

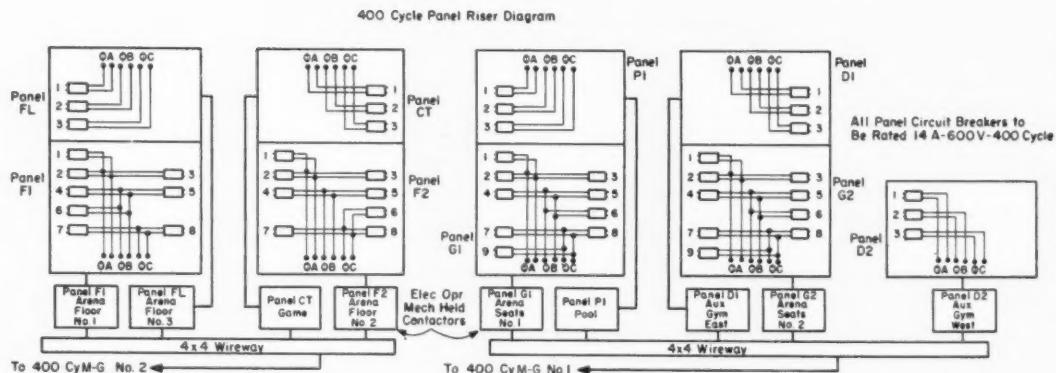
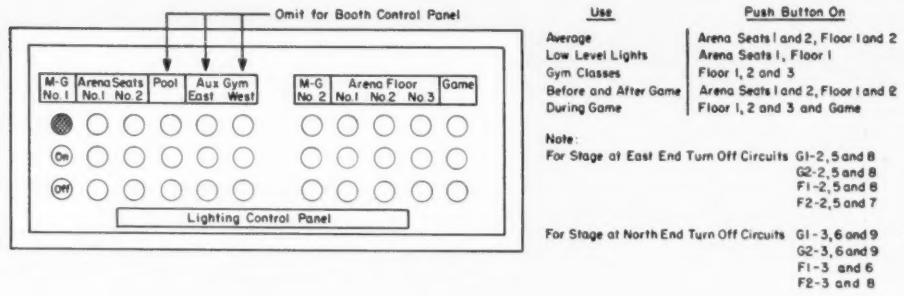


DIAGRAM OF PUSH-BUTTON CONTROLS IN MANAGER'S OFFICE AND 400-CYCLE PANEL WIRING.

advantages so we selected two disconnecting hangers for each fixtures. Two hangers were required for the large fixtures because of the weight and circuiting involved, and two hangers also were provided for the 2-lamp fixtures so they would line up properly when pulled into place.

Smaller Ballasts Used

A paper presented by Campbell and Dobras, of G.E., pointed out that higher-output fluorescent lamp development along 60-cycle lines appears to be reaching a point of diminishing returns resulting from increased ballast cost, weight, and size. Bigger and heavier ballasts require larger fixture channels and heavier and more expensive fixtures, and weight is important when fixtures must be raised and lowered for maintenance purposes.

The 2-lamp, 400-cycle ballast weighs only 3.5 pounds compared to about 9.5 pounds for the 2-lamp, 60-cycle ballast, and 15 to 20 pounds for the 2-lamp, high-output and power groove ballasts. This is a saving of at least 18 pounds for a 6-lamp fixture and 30 pounds for a 10-lamp fixture.

The cables for the hangers attached to the fixtures over the pool, the auxiliary gym, and the seats in the main arena were concealed in the walls along with the necessary hooks. Cables to the fixtures over

the arena floor were exposed through the ceiling joists and fastened to hooks attached to both sides of a catwalk at the center.

When we attempted to work out the hanger design with the manufacturers, the first thing they had to know was the weights of the large fixtures. We did not know these weights because the fixtures had not been built. In searching through the information on the Union project we found that the 14-lamp fixtures weighed about 220 pounds. From this we found a unit of weight per lamp and a unit of weight per square foot. Using these two units as a guide we felt the 10-lamp fixture should weigh between 157 and 158 pounds, the 6-lamp fixture 95 pounds, and the 2-lamp fixture between 31 and 32 pounds. These figures gave the hanger people some idea of what to expect. The actual weight of the large, medium, and small fixtures supplied turned out to be 140, 90, and 26 pounds, so our estimate was on the safe side.

Lower Noise Rating

Ballasts for standard, 8-ft Slimline fixtures have about the highest noise rating of any lamp ballasts made. On the other hand, ballast hum is reduced greatly, and losses also are reduced about 50 percent, at 400 cycles. While the frequency genera-

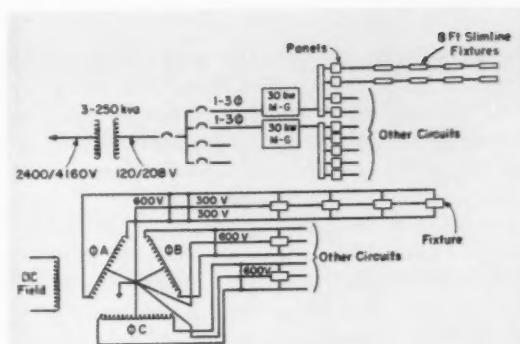
tors are not entirely free of heat and noise, they can be located where temperature and noise are not a problem. We located the two, 30-kw motor-generators in a small equipment room in one corner under the balcony seats of the arena. We louvered the door for cooling purposes, but found that the shrill generator noise does not hesitate to come out through the louver. If only Eugene Herzog had written his article (*CONSULTING ENGINEER*, January 1958) a year or two earlier, we would have learned that 400-cycle generators are noisier than 60-cycle units, and we would have located our units farther from the scene.

Virtually No Strobe Effects

When fluorescent fixtures first were used for gymnasium lighting there was some discussion of stroboscopic effect. At 400 cycles this is practically eliminated.

It also has been the practice in the past to specify ordinarily concentrating fixtures for high-bay installations because the idea is to light an area from the floor up to about eye level. Since the fluorescent fixture is inherently a widespread fixture it would appear to be less desirable. But the fact is that this large-area light source has a distinct advantage for gymnasium installations. Standard incandescent and mercury vapor lamps in concentrating-type fixtures produce spots of high brightness. These spots are distracting and can produce momentary blindness when the players or spectators look up to follow a ball during a game.

Most fluorescent lamp installations are made up of individual fixtures or rows of fixtures mounted end to end. The idea of grouping fixtures is something new. It was brought to our attention by the



GENERATOR WIRING PLAN KEEPS EACH 600-VOLT FIXTURE WITHIN 300-VOLT CODE REQUIREMENTS.

Union project where 35, 14-lamp fixtures had been used successfully. Our approach had to be a little different, however, because the architect and owner wanted four levels of illumination, since the main arena is used for many functions other than basketball. About 10 foot-candles were desired for general gatherings, while 5 foot-candles were considered adequate for low-level and security lighting. A 30 foot-candle level was a requirement for basketball practice, with 50 foot-candles over the main court for games.

It developed that 2-lamp fixtures had to be used throughout to obtain 10 foot-candles, 6-lamp fixtures for the 30 foot-candle level over the floor, and 10-lamp fixtures over the court for the 50 foot-candle level. We were fortunate for we discovered that an 8-ft, 10-lamp fixture is about as large a fixture as can be crated and shipped conveniently. (The Union College fixtures were shipped knocked



HIGH-BAY FLUORESCENT LAMPS GIVE SOFT, EVEN ILLUMINATION WITHOUT HARSH, BLINDING, BRIGHT SPOTS.

down and had to be assembled at the project site.)

To obtain 10 foot-candles throughout the arena area, we turn on all the 2-lamp fixtures over the seating area and also the two center lamps in all the 6- and 10-lamp fixtures. This simulates an installation of all 2-lamp fixtures. By turning off every other fixture we can cut the level to 5 foot-candles. For 30 foot-candles we turn on all lamps in the 6-lamp fixtures and the center six lamps in the 10-lamp fixtures, thus simulating an installation of 6-lamp fixtures. Turning on the remaining four lamps in the 10-lamp fixtures over the main court raises the level to 50 foot-candles.

Push-Button Controls

These illumination levels are obtained by a push-button control panel in the manager's office and the press booth. The manager's office has a view of the pool and auxiliary gym; the press booth overlooks the entire arena. From these locations it is possible to start the two motor-generator sets and control the 44, 2-lamp seating area fixtures, the 20, 6-lamp fixtures over the floor surrounding the court, and the 16, 10-lamp fixtures over the court. One push button is used to start each motor, and six push buttons operate the six contactors located close to the panels.

To further complicate the switching, the main arena is arranged so that a stage can be set up either on the east or north side. Overhead lighting in the stage area could be very undesirable, hence the branch circuits were arranged so unwanted fixtures could be turned off at the panels.

The added expense of the push-button panels and contactors is warranted. Operating the fixtures from the panels would allow unauthorized personnel to have access to the motor-generator room and a number of people would have had to be trained to know what circuit breakers to throw when. Now, by following a chart and a few simple directions at each push-button panel, anyone can achieve the desired illumination level with the light pattern always uniform and as originally designed.

If a generator kicked its breaker when the auditorium was filled with 6000 people, the results could be serious. The load requires a 30-kw generator for the fixtures over the floor and main court areas. Instead of increasing the size of the generator to include the seat lights, we decided to install a second, 30-kw generator to handle this additional load and provide 400-cycle current to the 10, 2-lamp fixtures over the pool and the 16, 10-lamp fixtures in the auxiliary gym. In this way, one generator becomes the emergency standby for the other. If the main, 2500-ampere breaker should trip, thereby stopping both motor-generators, exit lights and aisle lights guide people out of the building. In addition, 2-

lamp, battery-operated emergency lights, mounted on brackets at or in the stairwells, automatically turn on to provide additional illumination.

These fixtures are supplied with current at 600 volts. Yet the National Electrical Code does not permit a voltage higher than 300 volts. The generator windings are arranged to take care of this requirement. Instead of having three or four wires from the generator carrying 3-phase current, we have seven wires carrying single-phase current on three sets of two wires with one common ground wire. Generator windings are separated into three single-phase windings, each at 600 volts; hence three circuit breakers are required instead of one. The midpoint of each winding is connected to ground and brought out as the seventh wire to provide 300 volts to ground. This common ground is carried to each fixture so that each fixture is kept within the 300-volt limit. Because one ground wire and six circuit wires are connected to each 10-lamp fixture, two, 4-pole disconnecting hangers were required for the fixtures.

Using 600 volts saves wire. The longest run of any one panel branch circuit is 230 feet. With a current of less than 9 amperes, a number 12 wire provides a voltage drop of less than 1 percent at 600 volts. The same current at 120 volts would require a number 6 wire to keep the drop within 2 percent. Small wire not only reduced wire costs, but conduit and wireway costs as well.

Cost Comparisons

The item of cost always enters into any new design, and the UNM gym was no exception. The architect wanted a combination of incandescent and mercury vapor lighting, but we showed him that the 400-cycle design for the Union installation was about 10 percent cheaper than a comparable incandescent-mercury vapor system — so we went ahead with the design of the new system.

Campbell and Dobras made some cost studies comparing a 2-lamp, 60-cycle, 277-volt Slimline, industrial plant high-bay installation with a 2- and 10-lamp, 400-cycle, 600-volt layout providing equal lighting levels. Using the cost of the 2-lamp, 60-cycle design as 100 percent on an initial cost basis, the 2- and 10-lamp, 400-cycle costs were 84 and 78 percent, respectively. So multilamp fixtures appear to have a cost advantage, too.

While frequency converters, fixtures, and ballasts for 400-cycle systems are considered specialty items today, greater use should reduce unit prices. And continued research and development may well produce frequency changers that will be to the present-day motor-generator sets as the transistors in modern radio sets are to the old cumbersome vacuum tubes of the early '20s. ▲▲



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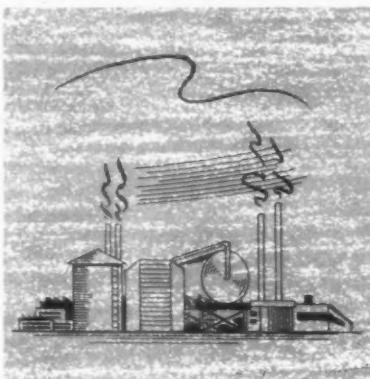
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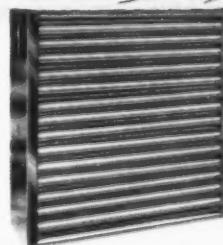


SPECIFICATIONS

| | No. 28 | No. 42 | No. 52 |
|-----------------------------|-----------|-----------|-----------|
| Size (Face Dimensions) | 24" x 24" | 24" x 24" | 24" x 24" |
| Depth (in dir. of Air Flow) | 8½" | 8½" | 8½" |
| Maximum Capacity | 1000 CFM | 700 CFM | 1000 CFM |
| Carbon Bed Thickness | ½" | ¾" | ½" |
| Approx. Weight of Carbon | 36 lbs. | 45 lbs. | 45 lbs. |
| Resistance * | 0.225" WG | 0.285" WG | 0.24" WG |
| Efficiency | 95% | 95% | 95% |
| Net Weight (cell only) | 87 lbs. | 92 lbs. | 97 lbs. |
| Shipping Weight | 110 lbs. | 115 lbs. | 120 lbs. |

*The resistance of Dorex C Cells will not vary provided they are protected against dust accumulation.

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ELECTRONIC COMPUTER AND DATA PROCESSING EQUIPMENT AT MICHAEL BAKER, JR., INC.

Setting Up a Computer Center



EDGAR C. RICHARDSON, Michael Baker, Jr., Inc.

Edgar C. Richardson joined Michael Baker, Jr., Inc., as a sanitary engineer in 1948. He has served in the capacity of design engineer and project engineer in three divisions of the firm. In 1957, he was appointed to the position of engineer-in-charge, electronic computer division. Mr. Richardson holds a B.S.C.E. degree from West Virginia University, is a registered professional engineer in the Commonwealth of Pennsylvania, and is a member of the National Society of Professional Engineers and the Pennsylvania Society of Professional Engineers.

DURING THE PAST TWO YEARS, much attention has been given to the use of electronic computers on highway engineering work. Sufficient progress has been made to indicate that these computers will play a definite and important role in future highway engineering activity.

Major changes in conventional highway engineering methods and approaches are being made. The highway departments of over half the states have put computers in operation in recent months. Reports indicate that about 40 electronic computers now are being used on highway work, including

both state highway departments and consulting firms. The total number of computers for this use is expected to reach 70 to 80 within the next year.

Research Analysis First

The interest in electronic computers at Michael Baker, Jr., Inc., was generated as a result of the need for conserving engineering manpower and time to meet the demands of the expanding highway program. During the past two years we have:

- ¶ Conducted a research analysis of our needs
- ¶ Selected and trained a computer staff
- ¶ Established a computing center
- ¶ Installed an electronic computer data processing system.

Our experience in the selection, installation, and use of the electronic computer will be useful to other firms engaged in highway work.

Our initial investigation into the use of an electronic computer was made by a three-member research team: two consultants from Massachusetts Institute of Technology and an engineer from our Special Projects Division. Both of the consultants had been actively engaged in highway engineering research projects involving the use of computers, and they had been closely following the computer activities of the state highway departments. The assignment of this research team was to determine the possible computer applications within the company

and the feasibility of those applications, to recommend a suitable computer system, and to take steps towards placing this computer system in operation.

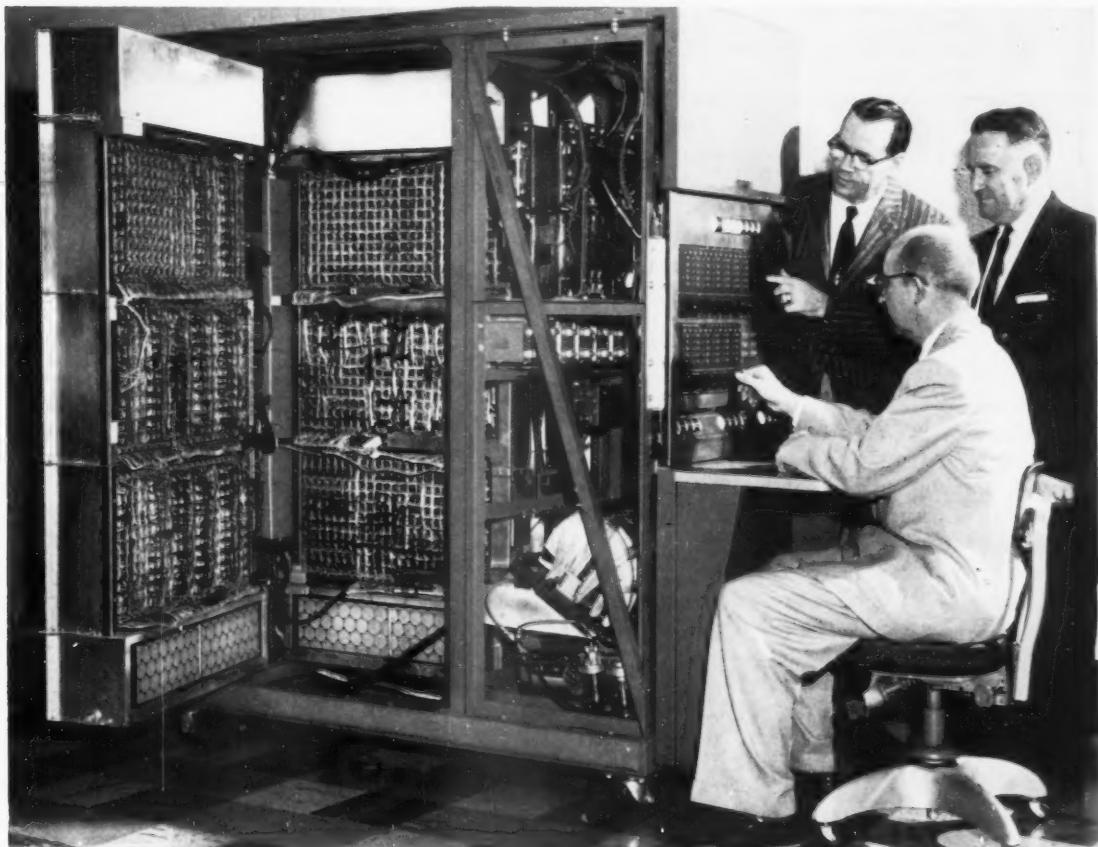
The first undertaking of the research team was to investigate fully existing company operations, especially those involving repetitive calculations. A study indicated that four types of problems in particular involved repetitive operations: bridge and interchange geometrics, earthwork computations, traverse computations, and structural computations.

Computer Serves Dual Role

Cost studies then were made in an effort to determine what part of this repetitive work would have to be handled by the computer in order that the cost of the computer center might be justified. It was found that this break-even point would be reached if 50 percent of all earthwork computations, 5 percent of the total bridge design activity, and 33 percent of all traverse computations were allocated to a computer. This initial allocation of work was considered to be practical. It further was determined that this work would use only 20 percent of the potential capacity of a computing center.

This study also brought to light another very significant factor — that a major potential benefit of computer utilization would be a more thorough analysis and evaluation of location and design solutions, resulting in better design, savings in con-

MICHAEL BAKER, JR., (STANDING AT LEFT) EXAMINES CORPORATION'S NEWLY INSTALLED IBM 650 COMPUTER.



struction costs and, therefore, the best possible service to the client.

Engineering firms should understand that the electronic computer can serve a dual role. Not only will direct time and cost savings to the firm be realized, but benefits to the client will accrue.

Intermediate Size Computer Leased

Having established to its satisfaction sufficient justification for the use of a computer, the research team next proceeded to select the computer most suitable for our needs. Working with representatives of various computer manufacturers, the team compiled data on costs, technical features, manufacturers' services, programming methods, applied science assistance, and related factors.

It was decided that our operations could best be accomplished through the use of an intermediate size computer. A small computer would not be versatile enough for our intended applications, and a large computer could not be justified by our volume of work. Concentrating on intermediate size computers, a comparative study was made of those commercially available, particularly those already placed in use by state highway departments.

The final selection was based primarily on the services offered by computer manufacturers, location of training schools, availability of applied science assistance, machine service, programming methods, and a detailed comparative analysis of the functional aspects of several computers. On this basis it was decided that the computer most suitable for our particular needs was the IBM 650.

The next phase of our study was to determine whether we should use a service bureau computer, lease a computer, or buy a computer. The use of a service bureau computer was considered inadvisable in that we wished to have full control of the equipment for scheduling purposes. We next considered the possibility of buying a computer but arrived at a negative decision mainly because of the obsolescence factor of this type of equipment. It was our opinion that, considering the rapid technological advances in computer development, a better and more economical computer might be available within a few years. We wanted to be in position to take advantage of all improvements. Our decision was to lease the computer from IBM, and they are responsible for its maintenance.

The remainder of the research team's work was to make recommendations as to space requirements, personnel, and utilities; advise on delivery dates; set up a time schedule; and estimate the initial and annual costs. The team was assisted greatly in this phase of its work by representatives of IBM.

The completed research report was given to management on April 12, 1957, and on April 23, 1957

FACTS ABOUT MICHAEL BAKER, JR., INC.

One of the largest consulting engineering organizations in the world, Michael Baker, Jr., Inc., employs a staff of over 1200 engineers, architects, and other technical personnel. Home offices are located in Rochester, Pennsylvania; 10 branch offices are maintained in six states and the District of Columbia; and there are overseas offices in Peru, Ecuador, Cambodia, and Jordan. The variety and scope of operations are accomplished through 12 company divisions covering all phases of civil engineering design, architectural design, supervision of construction, and related engineering services. No contracting or construction work is done.

Engineering services and production of plans currently are being furnished for projects having an average annual equivalent construction value of \$400 million. More projects are under way in 30 states and four foreign countries. The company also serves as consulting engineer to both the Pennsylvania Turnpike Commission and the Delaware River Joint Toll Bridge Commission, providing all consulting engineering services required under terms of the Trust Indentures for these two Authorities.

an agreement was signed with IBM for leasing a 650 computer and related peripheral equipment. Coincident with the signing of the lease agreement, the Electronic Computer Division of the company was formed, and orders were issued to develop a computer organization and establish a computing center at the earliest possible date.

Staffed by Company Personnel

Selection of the personnel to staff the proposed installation was started immediately. We decided to train design engineers and technicians to program the computer. These men were already thoroughly familiar with company design procedures, and we felt that this was better than hiring experienced programmers and attempting to teach them civil engineering design. Design sections were asked to recommend their best people for this new work, and a series of tests in elementary mathematics and aptitude were given throughout the company. From this group, four civil engineers, two mathematicians, and a secretary were selected to staff the computing center. In addition, design engineers from bridge and highway departments in the branch offices were selected for training in computer programming in order that an efficient communication system could be set up between the design sections and the computing center.

Arrangements then were made for training the selected personnel. The computing center staff at-



*He may be closing against a fault.
He's not worried...*



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with the **SAFE HPL-C
INTERRUPTER SWITCH**

**BUILT FOR SAFE OPERATION—
EVEN AGAINST SHORT CIRCUITS**



TOG-L SNAP—The high velocity blade operating mechanism. Optional, and important to safe closing-in operation.

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Up to 14.4 Kv (110 BIL)
400 Amperes—(40,000 Amp. Mom.)
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SAFETY FEATURES—(1) HPL-C closes in on special heavy closing contacts, outside the interrupter—thus preventing damage to the interrupter switch when closing in on moderate fault currents; (2) High velocity "OVR-CENTR" blade closing (and opening) with the TOG-L SNAP operating mechanism—an optional feature, providing additional safety, important especially during the closing operation. For safety sake, specify these important features.

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Supplied by leading electrical equipment assemblers, switchboard builders and transformer manufacturers in switchboards and unit substations.

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R&IE EQUIPMENT DIVISION
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tended a comprehensive series of courses at the IBM Pittsburgh office to train them in programming the 650 and in the operational use of all of our IBM equipment. The series of courses was completed in three months. The final instruction was a course in programming held at our office, in Rochester, Pa. It was attended by engineers and technicians from our highway, bridge, and photogrammetry departments.

During this same period, branch office design engineers were attending two week programming schools at IBM training centers in Atlanta, Washington, Philadelphia, and Harrisburg. By the end of this initial training period, 20 company design engineers and technicians had been trained in programming methods for the 650.

Six Weeks of Practice Programming

The computing center was located in a recently completed company office building near Rochester. Two adjoining offices of 1000 square feet each were selected. Favoring this location was the fact that the home office highway and bridge design departments, highway reports section, and city planning department had been relocated into this new building. The offices already were provided with sufficient air conditioning to meet the IBM 650 computer installation requirements. One room serves as the IBM equipment room and the adjacent room as the programming office. Sufficient space exists for future expansion of both equipment and the staff.

Following the completion of the training program, the computer staff occupied the new office and began a period of practice programming under the direction of IBM applied science personnel. This practice programming continued for approximately six weeks, with machine time for testing programs being made available through the cooperation of local industrial firms who had computer installations where the 650 was used for accounting work. By October 1957, the practice work had been completed, and we were ready to begin programming our engineering design applications.

The 650 computer and related equipment was installed in the computing center in December 1957.

Immediately Successful

The first applications selected for programming were the repetitive type problems mentioned in the research report. We investigated to see if existing programs available from the IBM program library could be adapted for our use and decided that the traverse and traverse adjustment programs written by the California Division of Highways could be adapted with little or no change. The remaining programs on earthwork computations, bridge geometrics, and structural computations had to be prepared to suit our needs. Our approach

to programming was that machine methods should follow as closely as possible existing manual methods with regard to submitted data and end results until such time as our design sections became familiar with computer produced calculations.

We were successful in our programming efforts in that by January 1958, we had nine programs in operation and were producing design calculations for traverse computations, interchange geometrics, grade profile calculations, polaris observations, various survey note reductions, and earthwork computations for design quantities and final quantities. We soon will have completed a comprehensive bridge geometrics program and two structural programs. Now our list of proposed programs has grown to some 81 possible applications, the major portion of which are in highway, bridge, and survey fields.

Some Operational Hints

To accomplish efficient communications between design offices and the computing center, all prepared programs are announced in advance by use of a program abstract. Following this abstract, a Users Manual, giving information as to the mathematical solutions involved, instructions on the submittal of data, and any necessary data forms, is distributed to all design sections. The final publication covering a program is an Operations Manual, which includes the Users Manual as well as sample solution, block diagrams, program listings, keypunch instructions, operator's instructions, and wiring diagrams. This Operations Manual is placed in the computing center library and distributed to all personnel who have been trained in programming the 650. By this means suggested program changes and improvements can be made by any design office engineer.

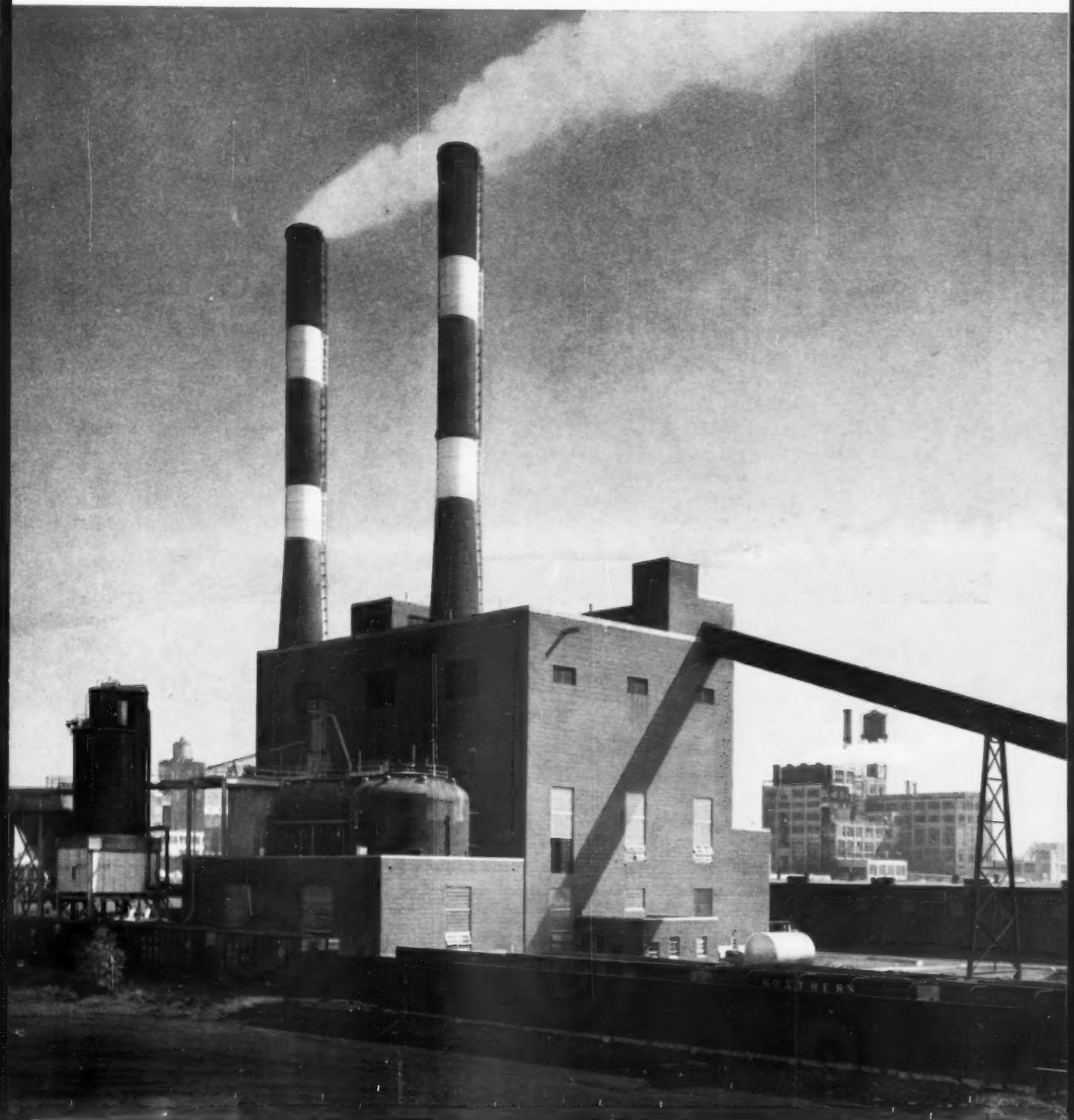
Communications between design offices and the computing center are accomplished by mail or telephone, depending on the urgency and amount of data to be submitted. Consideration is being given to the use of microfilm as a means of transmitting field book data, thereby eliminating the mailing of original field books—a somewhat dangerous practice. A system of leased wire communications also is being considered for service between the computing center and the major design offices.

Education in the use of the computer is being continued. A series of executive courses are under way to acquaint all officers and design supervisors with the operation and use of the computer. Off-duty classes, open to all personnel on a voluntary basis, are being planned for this spring. We intend to remove the mysteries presently connected with electronic computers and to make this powerful new tool as familiar to our firm as the present day desk calculator.

INDUSTRIAL POWER PLANTS

A Series of Project Studies . . .

With an Introduction by Alf Kolflat, Sargent & Lundy





Should Your Client Generate Power?

By ALF KOLFLAT, Sargent & Lundy

THE QUESTION of whether an industrial plant should generate its own power in conjunction with the production of process steam ultimately is governed by economic, management, and personnel considerations.

C_E exclusive European industries, particularly the old and established firms, have been using their own facil-

ties for power and process steam to a much greater extent than industries in this country. Here, the purchase of electricity and the separate generation of heating and process steam have been adopted widely except in certain processes where low pressure steam consumption is high in relation to power requirements.

A plant in which these conditions exist has every



Alf Kolflat was born September 26, 1896 in Kabelvag, Norway. He is a graduate mechanical engineer from the Norway Institute of Technology. After graduation, Mr. Kolflat worked for the Norwegian Government Railroad, in Trondheim, and then returned to the Institute to teach. In 1923, he came to the United States and worked as a laboratory test engineer in the Armstrong Cork Company's Insulating Plant, at Beaver Falls, Pa. A year later he became a power plant test engineer for the West Penn Power Company, and in 1925, joined the firm of Sargent & Lundy. In 1938, he was made a member of the firm; in 1940, chief mechanical engineer; in 1948, chief engineer; and on January 1, 1954, senior partner. Mr. Kolflat has served on several committees of the American Society of Mechanical Engineers and is a member of the American Nuclear Society.

reason to consider the generation of its own power. When low pressure steam consumption is high enough in relation to power requirements and a complete heat balance can be obtained without any steam going to the condensers, considerable heat can be saved in power generation. When the process steam and power loads, both in quantity and timing, permit generation of all power as "by-product power," then the heat requirement for power generation approximates 4500 Btu per kwh. If, however, the power is generated by steam condensation, it will require more than twice as much heat for power generation, even in the very best plant.

The superior heat economy of by-product power generation diminishes as the ratio of process steam to power is reduced and as the two types of load fail to coincide, as for example, in a heating plant where the steam requirements disappear in the summer, but the electrical load remains and even may be increased by the air conditioning load.

In order to obtain complete by-product power, it generally is necessary for the process steam requirements to be at least 35 pounds of steam per kwh of load, and the two services must follow similar load variations. There may be some departure from this ratio depending on what steam pressure is required for the process. Assuming 800 and 1200 psig as two likely boiler pressures, and assuming heating and process steam used at 50 psig, then the theoretical ratio is 25 and 22 lbs per kwh for the two pressures. If the process steam is required at 150 psig pressure, the ratio is 35 and 30 lbs per kwh.

In the paper industry, the process steam approximates 25 to 30 lbs per kwh of electricity used. In the corn processing industry, the approximate fig-

ures today are 30 to 35 lbs per kwh. Similar figures for cereal manufacturing are 8 to 10 lbs per kwh, and for chemical plants they vary between 5 and 20 lbs per kwh.

With these large theoretical savings in heat, why are industrial power plants not more popular than they are? An answer is to be found in several adverse factors.

In order to provide reasonable standby, more expensive equipment, built for higher steam pressure, is required if the industrial plant is to furnish both power and steam. When the coincident demands of steam and power are considered, only a few industries have a sufficiently high steam process requirement in relation to power to obtain a complete heat balance without some condensing, and condensing increases first costs as well as water requirements substantially.

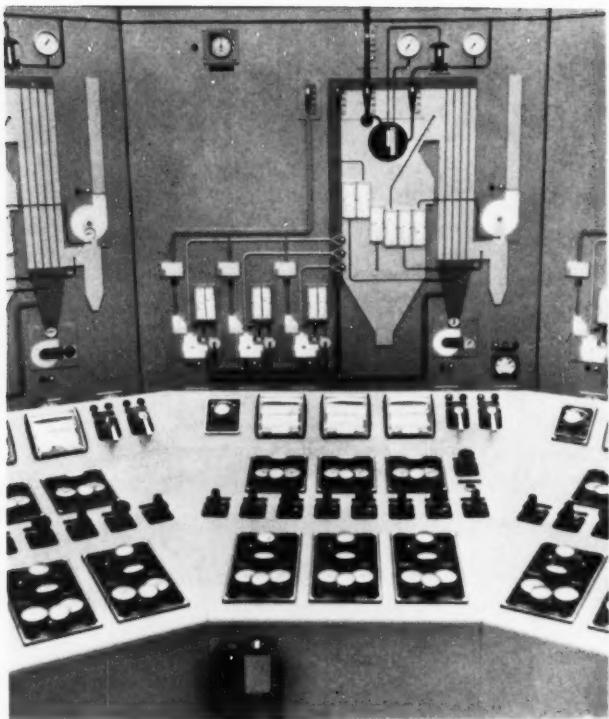
Most industries want a high percentage return on capital invested in processing equipment because of the uncertainties of the future, and they expect the same percentage return on their expenditures for power generating facilities.

The last few years have shown a rapid increase in the cost of equipment, which makes it more and more difficult for a company to make any large-scale equipment investments that are not absolutely necessary for production. They also favor purchasing power services, even at a higher direct cost, for their power bills can be charged to operation expenses, giving them a better tax position than they could get by depreciation of a capital investment.

Another factor which has had a major effect in recent years also has to do with high corporate taxes. Any profit made through combining power generation with process steam production is cut in more than half by the 52 percent (or greater) tax on corporation profits. This discourages capital expenditure for anything but direct and necessary manufacturing facilities.

The question of cost and availability of competent operating personnel is an important factor, particularly for the smaller plant where the labor portion of the operating cost is much greater than for a larger plant. Coupled with this is the feeling by many industrial managements that power generation is outside their main manufacturing purpose and therefore represents something of a nuisance. They would rather concentrate on manufacturing problems and leave power generation to the utilities.

It is quite obvious that there is no simple answer. All factors must be considered separately for each project, first getting the proper background and perspective of the plant requirements and then projecting them to the future, keeping in mind that in practically every industry the power requirement per unit of product is increasing year by year.



CENTRAL CONTROL ROOM HAS GRAPHIC PANELS BEHIND A BENCH SECTION ON WHICH MANIPULATIVE CONTROLS ARE CONVENIENTLY LOCATED FOR OPERATOR.

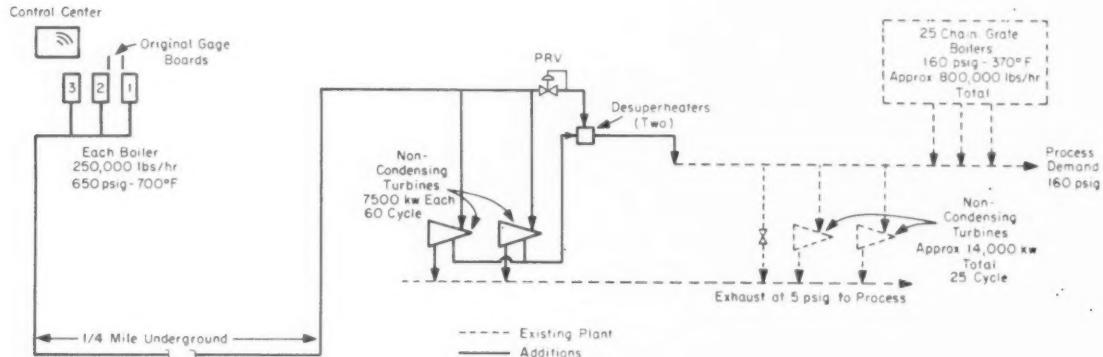
Argo Plant, Corn Products Refining Company

Sargent & Lundy, Consulting Engineers

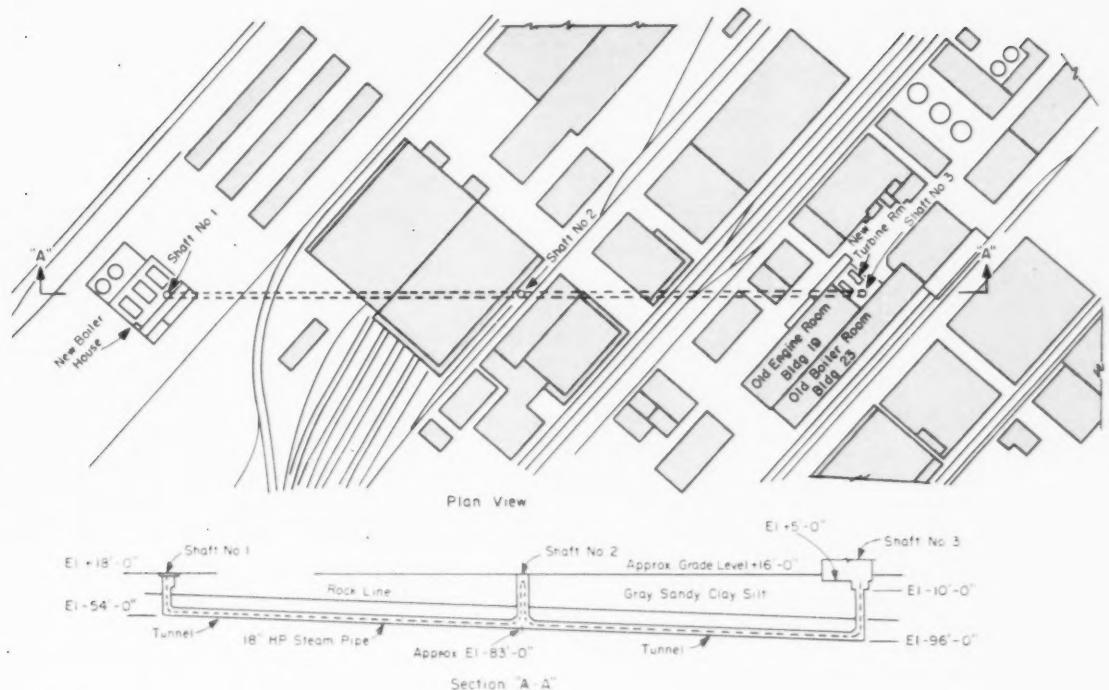
THE ARGO PLANT of the Corn Products Refining Company is one of that firm's major production facilities. It was built in 1908 on the outskirts of Chicago and always has generated its own steam and most of its electric power. The original electric system was 25 cycle, and the plant contained 14,000 kw of generating capacity at this frequency in turbines and engines, plus 25 chain-grate, stoker-fired boilers having a capacity of 800,000 lbs per hr and operating at 160 psig. The plant utilizes large quantities of steam at 160 psig and 5 psig.

Increased growth of the plant and the age of the equipment called for new steam and electric generating capacity. Extensive studies were made of the desirable heat balance, steam pressure, frequency, and distribution system. As a result of these analyses, there have been installed over the last 10 years two, 7500-kw turbine generators and three, 250,000-lb per hr steam generators operating at 650 psig and 700 F, each with three coal pulverizers.

The turbines are noncondensing, extraction type, exhausting at 5 psig with one automatically con-



FLOW DIAGRAM SHOWS THREE NEW BOILERS AT LEFT; TURBINES, CENTER; OLD UNITS, RIGHT.



STEAM FROM NEW BOILERS MOVES $\frac{1}{4}$ MILE UNDERGROUND TO TURBINES NEAR OLD ENGINE ROOM.

trolled extraction at 160 psig. The remaining old boilers tie into the 160 psig header and the old turbines and engines exhaust to the 5 psig system.

The new generators are 60 cycle and operate at 12,500 volts, power at this voltage being distributed throughout the area by underground cables to strategic load centers. There are ten indoor unit type substations each with 1000-kva, 3-phase, dry-type transformer with low voltage switchgear at 480 volts for the distribution feeders to the various motors. No interconnection is provided between the 60-cycle and the old 25-cycle system, but the 25-cycle motors are being replaced by 60 cycle whenever changes are justified.

It seemed advantageous to retain the location of the old power house because an extensive low and high pressure steam system as well as all electrical facilities radiated from that location. It was, however, impossible to find space for new boilers without first tearing out the old, and that would not have been practical. Also, continuing coal and ash handling in this location was not desirable, since there are adjacent food processing buildings.

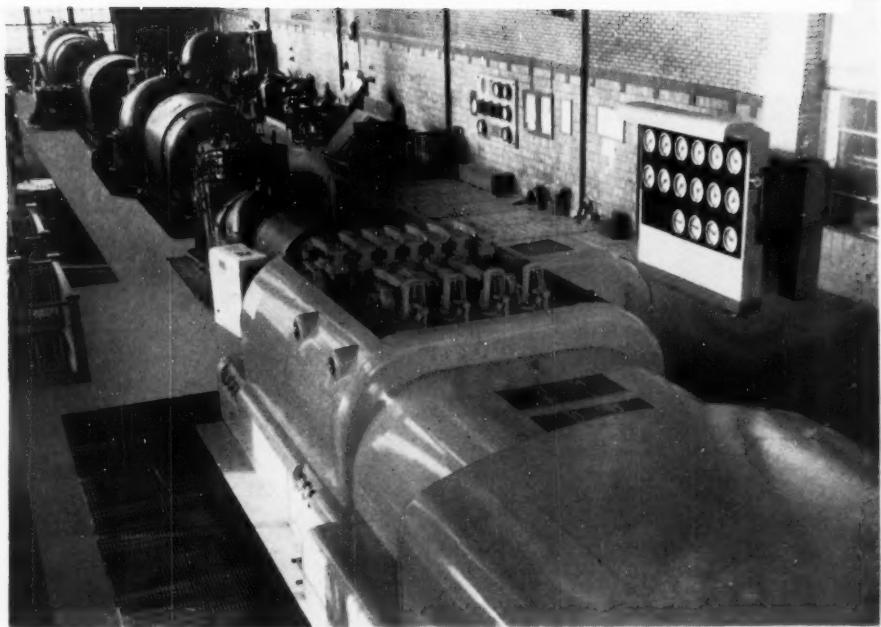
It was finally decided to locate the two new turbine generators adjacent to the existing power house where space was available so that the existing steam and electrical distribution could be retained. Then, it was decided that the boiler house would be

placed approximately 1800 feet away where there was adequate space for coal and ash handling. Because of the many buildings between these two locations and an extensive system of railroad tracks the two sites were connected by a tunnel approximately 100 feet below grade. The tunnel is designed to accommodate two 18-inch steel pipes for 600-psig steam as well as make-up and well water piping and other interconnected services between the boiler room and the turbine room.

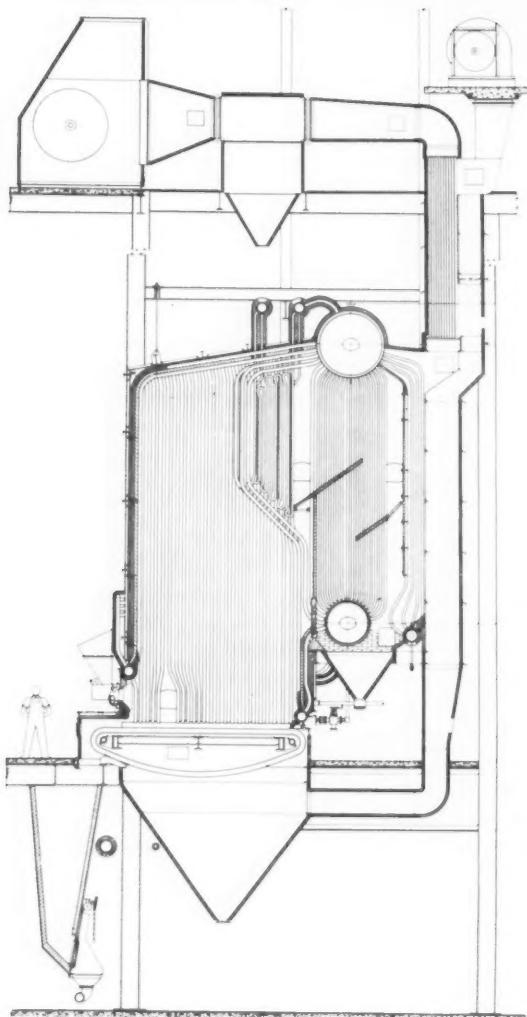
The new plant is provided with a centralized control room for the control of three boilers. Based on their wide experience in the operation of chemical plants, the engineers of the Corn Products Refining Company felt it desirable to have graphical representation in the arrangement of instruments on the control board. The board consists of a bench section for instruments and controls that must be within the reach of the operator and vertical panels for those that require only observation. The control room is arranged for an ultimate of 6 boilers. The room is air conditioned and well lighted with a suitable color scheme and it has resulted in a saving of manpower, the maximum of efficiency of operation, and improvement of morale.

The plant now supplies most of the electrical power requirements, but an interconnection is provided with the utility at 12,000 volts.

A VIEW OF THE TURBINE ROOM WITH THE NEW UNIT SHOWN IN THE FOREGROUND.



CROSS-SECTION OF TWO NEW BOILERS SUPPLIED BY ERIE CITY IRON WORKS.



Muskegon Plant, Continental Motors Corporation

Roland W. Berger & Associates,
Consulting Engineers

CONTINENTAL MOTORS CORP. is the largest independent producer of internal combustion engines in the world. Their new power plant for the main plant in Muskegon, Mich., represents the largest single investment (\$2.5 million) made in the company's history. It has resulted in substantial savings in the cost of production of process steam, heat, and electrical energy.

The original power plant, supported on 2600 wooden piles, was built in 1921. It had in it eight boilers, with a total capacity of 360,000 lbs per hr at 175 psig, and total temperature of 475 F, fired by forced draft traveling grate stokers, and drafted by two refractory lined steel stacks, 175-ft high x 11-ft diameter at the top, with their bases at the boiler room roof line.

The power generating equipment consisted of three turbine-generators, each 2500 kw, and one turbine-generator rated 1500 kw; a total of 9000 kw.

operating at 2300 volts and equipped with jet condensers. This manufacturing plant requires considerable steam at 175 psig, in addition to space heating steam at 5 psig.

An increase in the demand for dependable electrical power resulted in a tie-in with the utility. This connection was made in 1948 through a 10,000-kva transformer bank, 4160 volts to 2300 volts.

Further increase in the company's business and related increase in demand for power resulted in studies being made to determine the most efficient and economical method to increase the generating capacity of the plant for both steam and electrical power to obtain a satisfactory heat balance. It was decided to build additions to the existing plant to provide for new boilers, a water treating system, and a new turbine.

A new water intake, with submerged crib in Muskegon Lake, and a new outfall also were installed.

Two new boilers to operate at 625 psig and final temperature of 750 F, were installed in a space provided by the removal of two old boilers, plus a building addition. The new boilers were equipped with economizers, air heaters, dust collectors, continuous blowdown system with heat recovery equipment, and induced draft fans with stub stacks. Each boiler has a continuous steam capacity of 100,000 lbs per hr, and peak capacity of 120,000 lbs per hr for two hours. Ashes are removed by a new pneumatic ash conveyor system with storage tank.

The new water treating system makes use of a hot lime treatment, followed by filters and hot

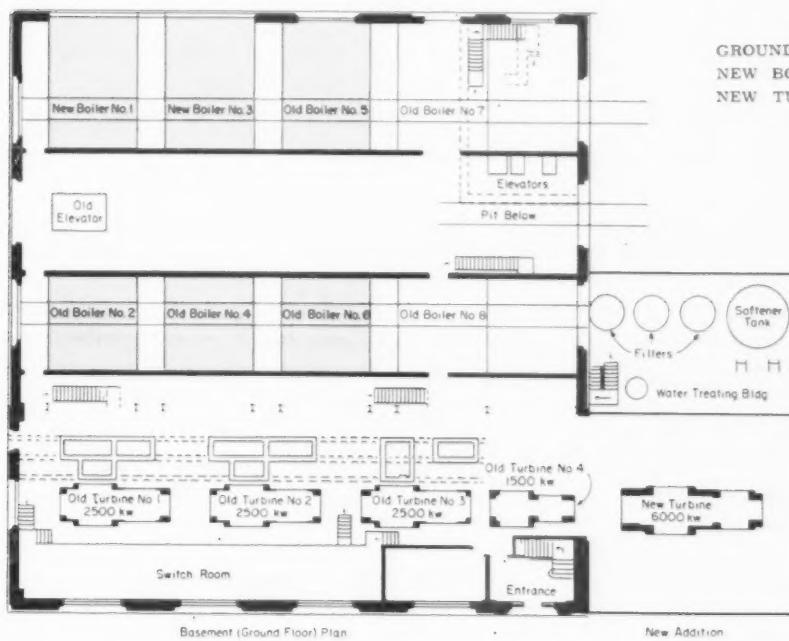
zeolite, all installed with deaerating heater and boiler feed pumps in a new building addition, part of which also houses the new turbine-generator. This building is supported on concrete filled 10.75-in. O.D. steel piles. These piles are believed to be the longest of this type ever driven.

The new 6000-kw turbine-generator operates at 600 psig and 750 F. It is a condensing type and is provided with double automatic extraction at 175 psig and 5 psig. It is wound for 4160 volts.

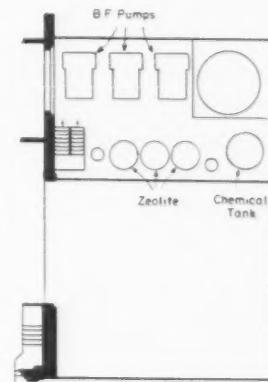
A new reducing and desuperheating station, 600 psig to 175 psig and 750 F to 475 F, was installed. It is pneumatically operated and tied-in with the 175-psig automatic extraction mechanism of the new 6000-kw turbine-generator.

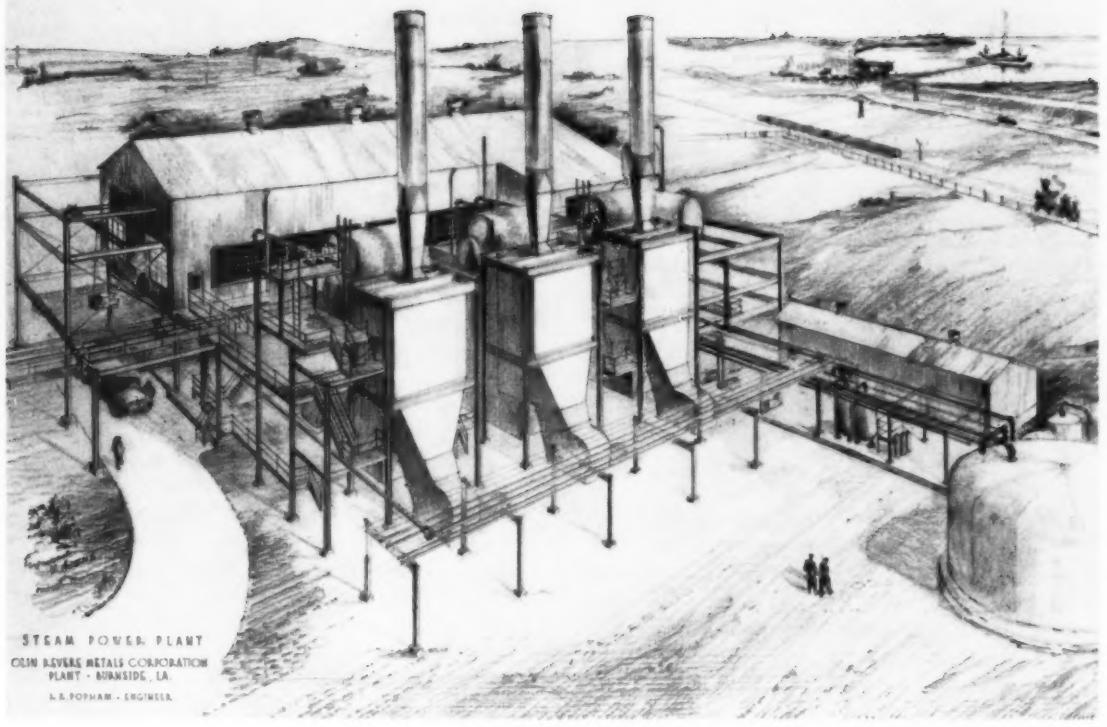
All new switchgear was installed for the four, old, 2300-v turbine-generators. All new switchgear consisting of a total of 29 metal-clad switchgear units was provided for the new 4160-v turbine-generator. Considerable improvement and modernization of the primary and secondary distribution system throughout the manufacturing area followed the power plant modernization.

This installation provides for the use of the old boilers and old turbine-generators mainly as standby equipment, thereby obtaining a full return on the original investment. With the tie-in between the new boilers through the reducing and desuperheating station, it is possible to operate the new turbine or the old turbines, or a combination of the new turbine and any of the old turbines, with or without extraction steam from the new turbine.



GROUND FLOOR PLAN OF POWER PLANT.
NEW BOILERS ARE IN TOP ROW, AND
NEW TURBINE IS AT BOTTOM RIGHT.

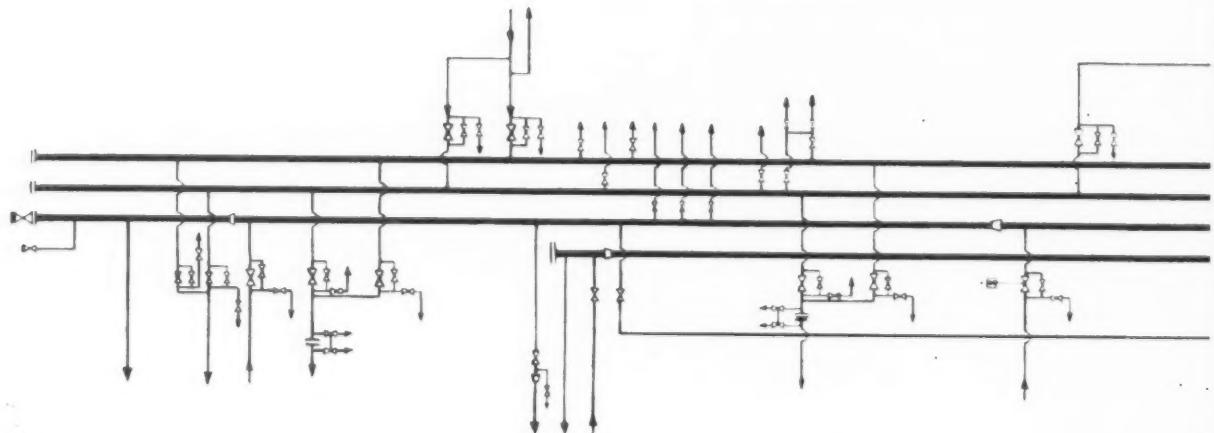




PENCIL RENDERING OF THE NEW POWER PLANT FOR OLIN REVERE METALS CORPORATION, BURNSIDE, LA.

Ormet Plant, Olin Revere Metals Corporation

R. R. Popham, Consulting Engineer



PRINCIPAL PLANT EQUIPMENT

Steam

THE NEW ORMET PLANT of Olin Revere Metals Corp. was designed to provide not only electric power and process steam but also compressed air. If any one service is interrupted, the plant will continue to deliver the others.

The normal fuel supply to the power plant is natural gas, which is available at an attractively low cost. If the gas supply should fail or be interrupted, the plant will burn standby fuel oil. An interesting feature is the choice of Number 2 domestic burner grade fuel oil instead of the cheaper and heavier oils. The light fuel was selected because it can be burned without preheating, and is instantly available, even after long periods of shutdowns. The light fuel also is expected to considerably reduce burner cleaning and maintenance in a normally gas operated plant.

Three boilers, each having a capacity of 115,000 lbs per hr at 625 psig, 750 FTT.

Electric Power

Two, 4000-kw (5000 kva) condensing automatic extraction type turbine-generators. One, 4000-kw (5000 kva) back pressure type turbine-generators, exhausting at 160 psig.

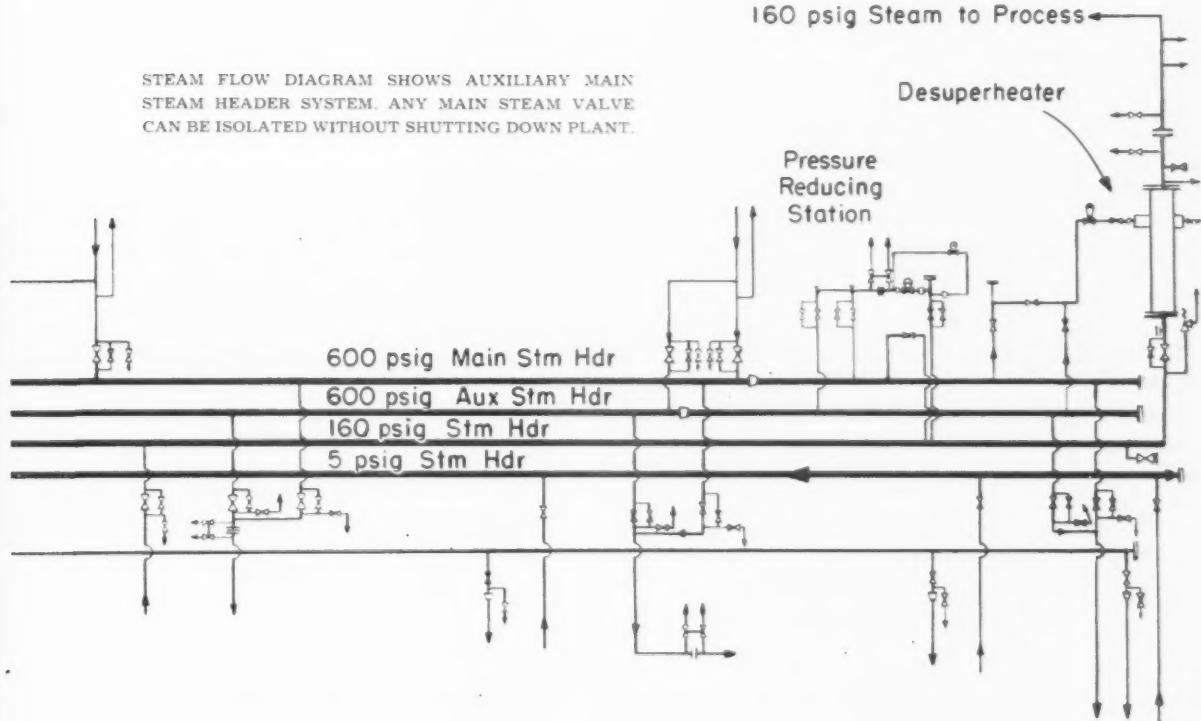
Compressed Air

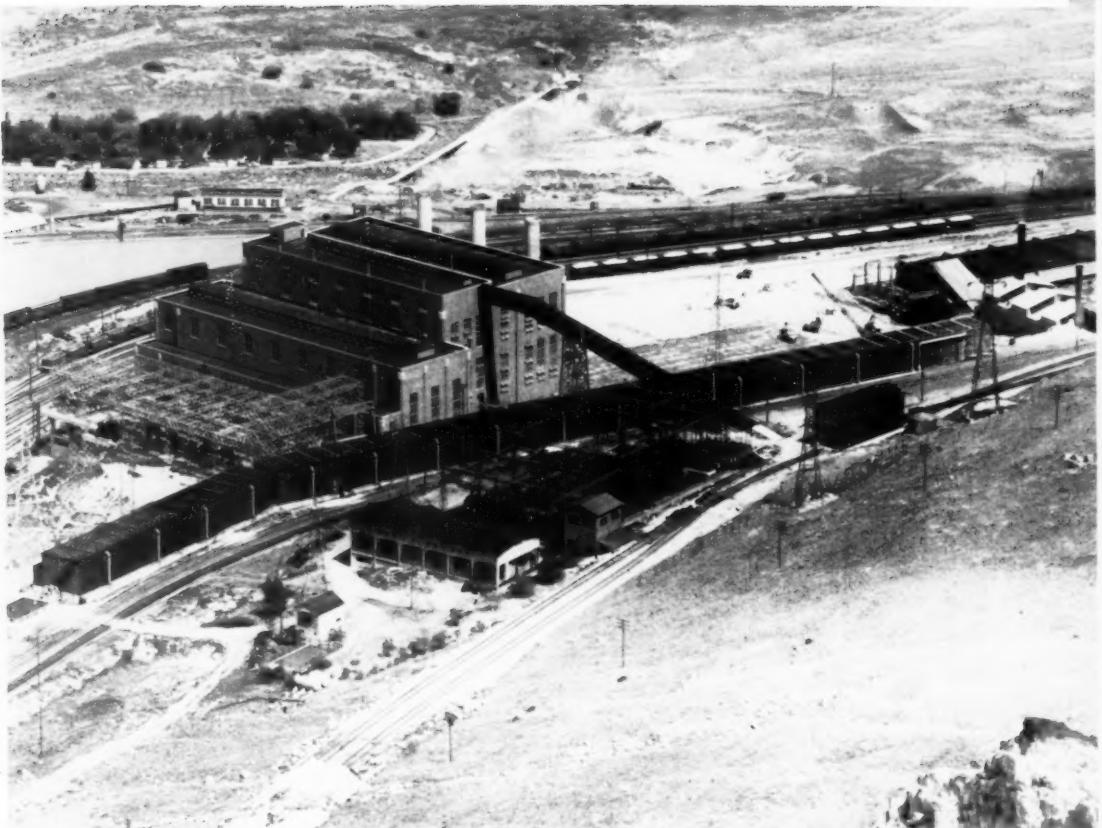
Two, 2000 shaft bhp turbine-driven compressors, each rated 8000 cfm at 125 psig.

Water Treatment

Demineralizing type water treatment plant with a capacity of 125,000 lbs per hr.

STEAM FLOW DIAGRAM SHOWS AUXILIARY MAIN STEAM HEADER SYSTEM. ANY MAIN STEAM VALVE CAN BE ISOLATED WITHOUT SHUTTING DOWN PLANT.





MAGNA MILL POWER PLANT FURNISHES ENERGY FOR MINE, MILL, ORE HAULAGE, AND REFINERY.

Utah Copper Division, Kennecott Copper Corporation

The Kuljian Corporation, Consulting Engineers

DESPITE THE FACT that the world's copper production now exceeds demands for the first time since 1953, Kennecott Copper Corporation is undertaking a power expansion project that will boost their Utah Copper Division's central power station's capacity from 100,000 to 175,000 kw.

Electrical energy for Utah Copper's mining, milling, ore haulage, and refinery needs is supplied entirely by this central power station.

By extending this station to an existing barometric drain house, it will be possible to house all the power equipment except the boiler itself, which has been designed as a semioutdoor unit.

Steam supplied to the turbine will come from a new 600,000-lb per hr boiler, which will be fired by natural gas. During the winter, however, pulverized coal will be used for several weeks while the greater part of the natural gas supply in the area is consumed for residential heating.

Because the original coal handling system was not adequate to serve both the old units and the new,

the car unloading station will be extended to increase its capacity and to serve a conveyor for outside coal storage. The inclined conveyor from the car unloading station to the coal bunker floor level will be increased to handle 360 tons of coal per hour, and a new bunker tripper will be installed to fill both the existing and the new bunkers.

A new 20-in. diameter gas supply pipeline of approximately 5000-ft length will run from the gas supply station to the new boiler.

To facilitate easy maintenance, all floor levels are to be maintained through the new extension, and they will be serviced by existing elevators. A combined turbine and boiler control panel is to be installed on the present operating floor for the new unit, making it possible to run the entire plant without additional operating personnel.

The generator leads, which are of isolated phase duct construction, will connect the 75,000-kw, 96,000-kva, 13.8-kv, 3-phase, 60-cycle generator to its associated 90,000-kva, 13.8/55-kv, 3-phase step-up

transformer. A tap from the bus duct will connect to the 7500-kva station auxiliary transformer, and another tap will be joined to the surge protection and potential transformer cubicle.

The six-extraction turbine is a 3600-rpm tandem compound double-flow reheat machine with design conditions of 1450 psig, 1000 F, with reheat to 1000 F at the turbine throttle inlet. Although this unit is rated at 75,000 kw at 2.0 in. Hg abs, anticipated maximum output will be nearer 87,000 kw.

In a large 3600-rpm tandem compound unit, the turbine's exhaust loss becomes quite high, and normally a cross compound unit consisting of two separate turbines is utilized. Reheating is done as the steam goes from one unit to the other. However, a tandem compound unit was chosen for this installation because of space limitations.

This equipment has steam seals for shaft packings with completely automatic control so that sealing can be established while running on turning gear, and full vacuum is accomplished. The unit can be started and loaded without further attention to the seal system.

The generator, which is hydrogen cooled, will generate power at 13,800 v and have a capability of 75,000 kw at 0.85 power factor, 15-psig hydrogen pressure, and with 90 F water supplied to the hydrogen coolers. Excitation is by a 240-kw, 1800-

rpm, 250-v main exciter driven from the main shaft through a reduction gear. A pilot exciter is supplied to provide excitation to the main exciter.

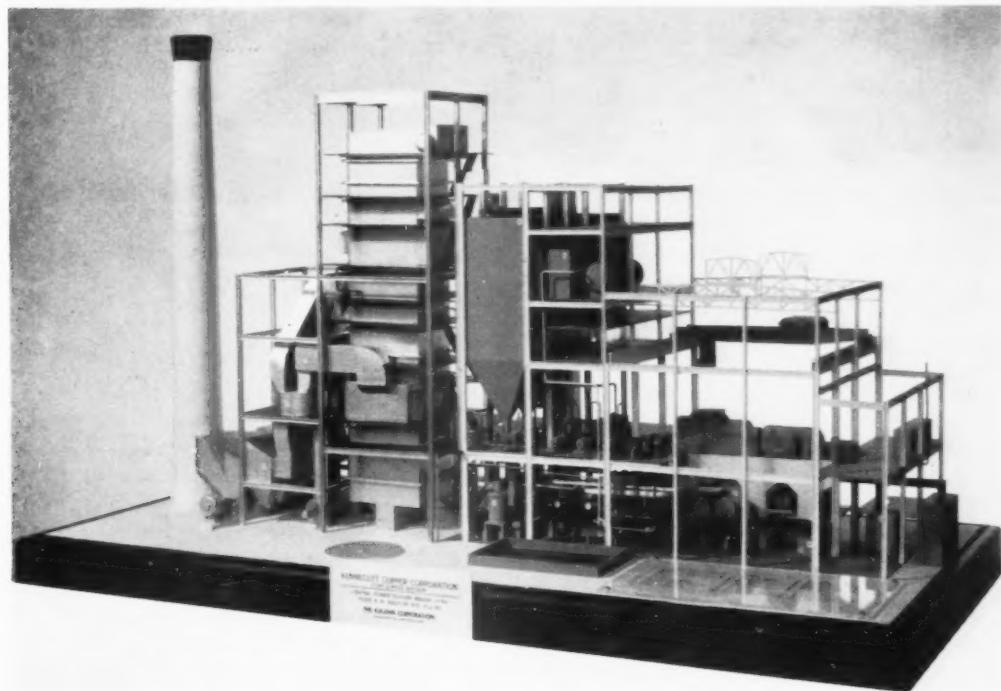
The boiler is rated at 600,000 lbs per hr at 1525 psig superheater outlet pressure, 1010 F primary steam temperature, 1010 F reheat temperature.

Very often the superheat, hot reheat, and cold reheat connections are located on top of the boiler, but this unit was supplied with these connections located midway on the side of the unit, facing the turbine generator. As a result, the comparatively short lengths of chrome-moly piping running to the turbine will effect a substantial savings in the cost of the piping installation.

The boiler is fired by tilting tangential burners designed for both gas and coal. The combination of tangential firing and tilting burners provides temperature control of the exit gases.

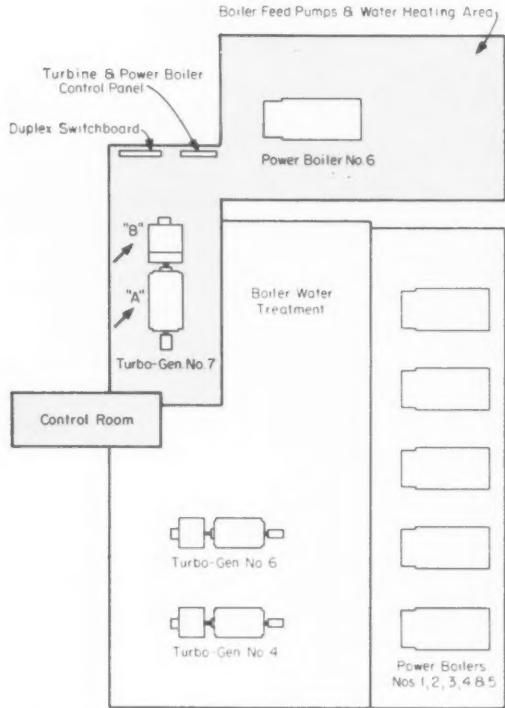
A two-pass, 58,000-sq ft surface condenser was selected. This condenser is designed for 51,000 gpm of cooling water at 80 F inlet temperature. Water at 96 F leaves the condenser and is returned to a 4-cell cooling tower where the water is again cooled at 80 F with a design wet bulb temperature of 65 F.

Unlike a public power utility which handles peak loads only during certain periods of the day, the station operates at an unusually high load factor of 96 percent.

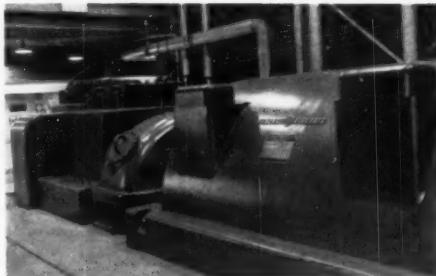
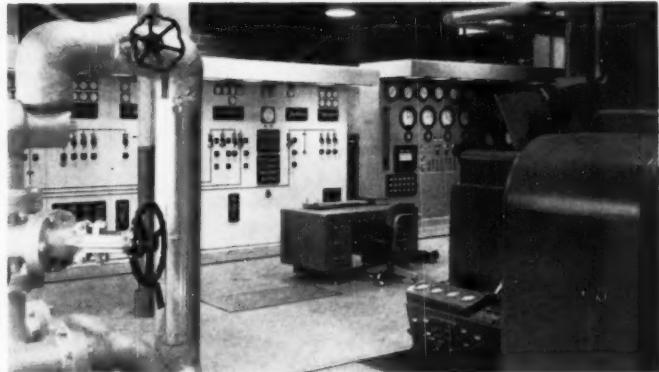
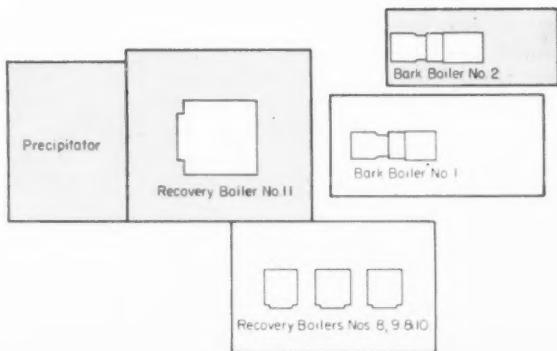


MODEL OF 75,000 KW ADDITION SHOWS ARRANGEMENT OF BOILER, TURBINE, AND AUXILIARIES.

NEW BUILDINGS AND EQUIPMENT ARE SHOWN SHADED IN THIS FLOOR PLAN OF THE POWER PLANT AT CONTINENTAL CAN CO., HODGE, LA. PHOTOS (SEE "A" & "B" ON THE DRAWING) SHOW THE NEW TURBINE AND CONTROL PANEL.



Note: Arrow (→) indicates Direction of Photographs



Southern Advance Bag Operation, Continental Can Co., Inc.

J. E. Sirrine Co., Consulting Engineers

PRIOR TO EXPANSION of the plant for increased production, the major power plant equipment included:

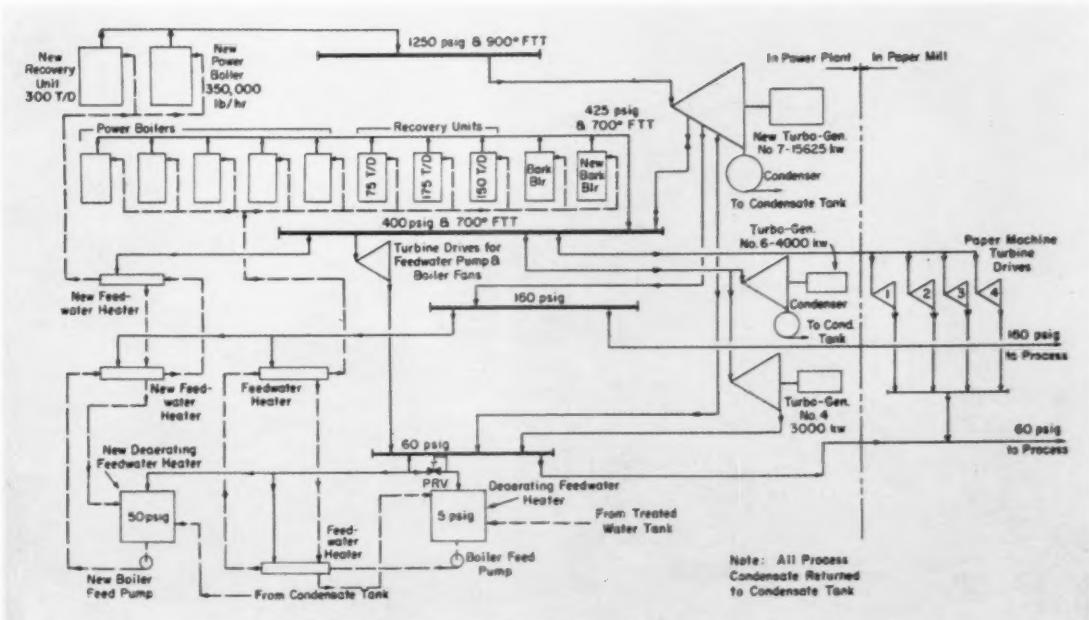
- † Three power boilers of 24,000 lbs per hr capacity each and two power boilers of 32,000 lbs per hr capacity each, all fired with natural gas and producing steam at 425 psig and 700 F.
- † One chemical recovery unit (black liquor boiler) with capacity equivalent to 75 tons of pulp per day, one 175 tons per day unit, and one 150 tons per day unit, all operated at 425 psig and 700 F.
- † One bark boiler of 60,000 lbs per hr capacity

fired with wood bark and refuse and operated at 425 psig and 700 F.

† Six turbo-generators, rated as follows:

- 2500 kw, 385 psig, noncondensing
- 2500 kw, 385 psig, condensing
- 2500 kw, 385 psig condensing
- 3000 kw, 400 psig and 700 F, noncondensing
- 3000 kw, 150 psig, condensing
- 4000 kw, 400 psig and 700 F, condensing

Auxiliary equipment included a deaerating feed-water heater for 5 psig operation together with



SCHEMATIC FLOW DIAGRAM OF THE WHOLE POWER PLANT SHOWING TIE-IN OF ALL NEW EQUIPMENT.

necessary boiler feed pumps, heaters, and controls.

The flue gas from the bark boiler was arranged to discharge through the fuel preparation Blow-Hog to assist in drying the wood bark and refuse before it is fired in the bark boiler.

Based on the planned expansion, an extensive heat balance and economic study was made in conferences with the owner's engineers, and the resultant power plant is shown in the illustrations.

All chemical recovery units, all power boilers, and turbo-generators No. 4 and No. 6 were retained. The other turbo-generators were eliminated.

The major items of new equipment added were:

- * One chemical recovery unit, capacity equivalent of 300 tons of pulp per day (148,400 lbs of steam per hour) — operated at 1250 psig and 900 F. This unit is equipped with economizer and has the "steel shot" cleaning system. Auxiliaries for this unit include soot blowers, evaporator, steam air heater, salt cake feeder and silo, motor driven forced draft fan, and motor driven induced draft fan, together with necessary pumps, liquor heaters, instruments, and controls.

- * One natural gas fired pressurized furnace power boiler having a capacity of 350,000 lbs per hr of steam—operated at 1250 psig and 900 F—equipped with air heater and motor driven forced draft fan.

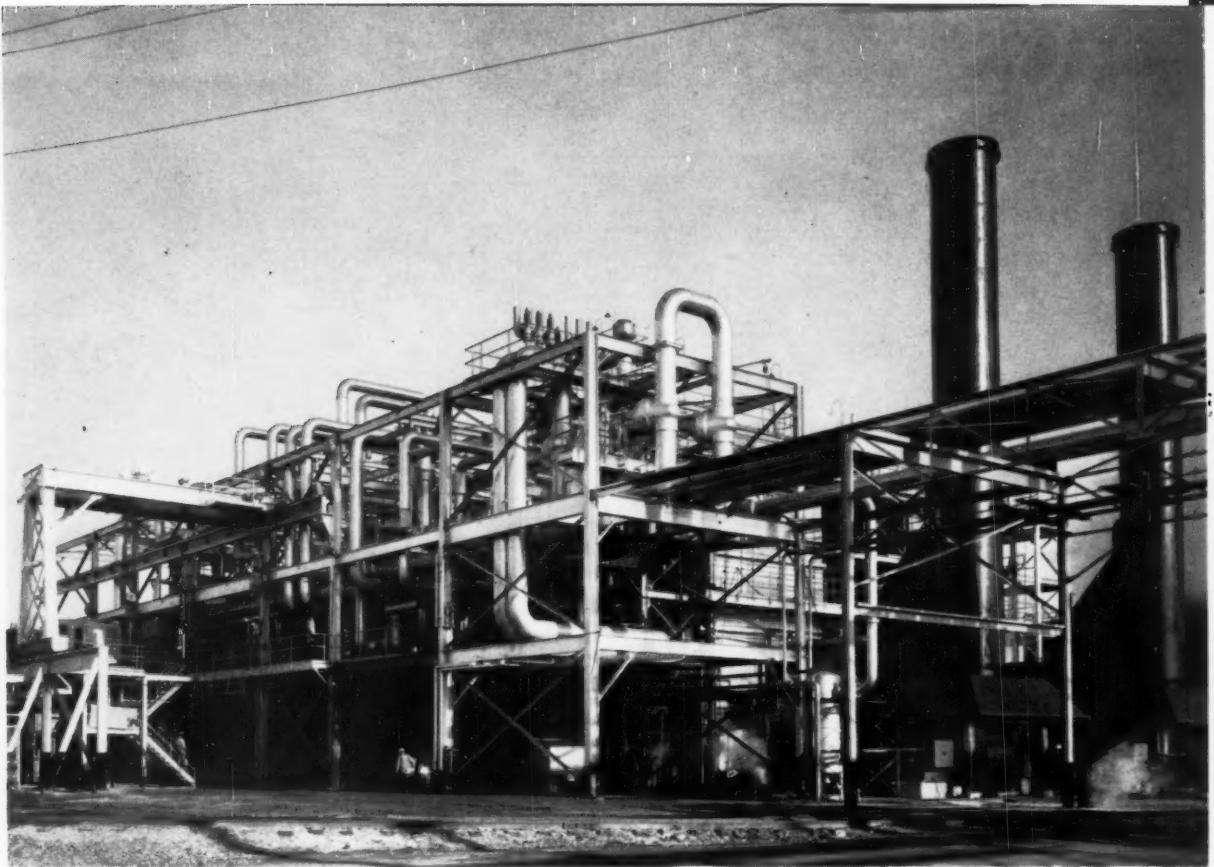
- * One bark and wood refuse boiler having the capacity to produce 60,000 lbs of steam per hour and operated at 425 psig and 700 F. This unit is equipped with a continuous ash discharge spreader stoker, air heater, soot blowers, auxiliary natural

gas burner for full capacity, fly ash collector, motor driven forced draft fan, motor driven induced draft fan, and combustion control equipment. The flue gases are fed through a new fuel preparation Blow-Hog, which reduces the moisture content of the wood fuel. An electrostatic precipitator is installed in the discharge gas path of the chemical recovery unit to collect the salt cake that is in the gas stream. This unit is automatic in operation, has a 90 percent collection efficiency and a 122,000 cfm gas capacity.

* A turbo-generator, having a turbine capacity of 15,625 kw, with 25,600-kva, 30-lb, hydrogen cooled generator, operates at 13,800 volts, 3 phase, 60 cycle, 3600 rpm, and is equipped for triple automatic extraction at 425 psig, 160 psig, and 60 psig, with an uncontrolled extraction opening at 250 psig. This unit also is designed for steam admission at 425 psig. The steam conditions at the throttle are 1250 psig and 900 F with exhaust at 2-in. Hg abs. The generator is hydrogen cooled. The surface condenser, with 11,000 sq ft of surface, uses 85 F water and is of the two pass, divided water box design.

* There are two, new, steam turbine driven boiler feed pumps, each having a capacity of 1200 gpm and total head of 3450 feet. These pumps are each driven by a 1220-hp steam turbine, using 400 psig and 700 F steam and exhausting at 60 psig.

* A new deaerating feedwater heater of 800,000-lb per hr was installed. This unit is designed for 50-psig working pressure. It is made of copper bearing steel and has stainless steel trays. It has an external condenser and 8000-gal storage capacity.

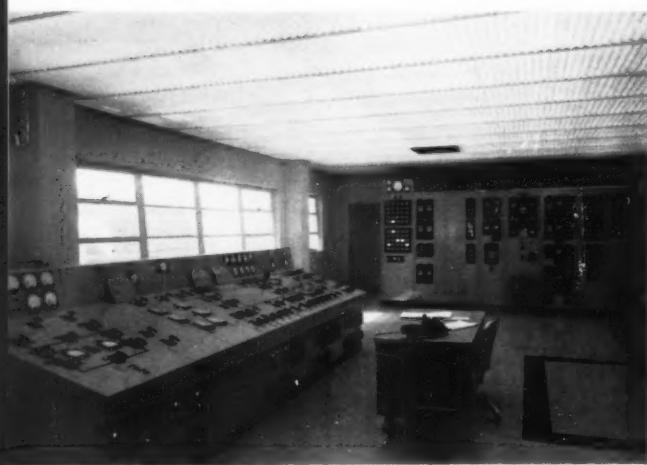


GENERAL VIEW OF NEW OUTDOOR POWER STATION OF THE TEXAS COMPANY'S PORT ARTHUR WORKS

Port Arthur Works, The Texas Company

Jackson & Moreland Inc.

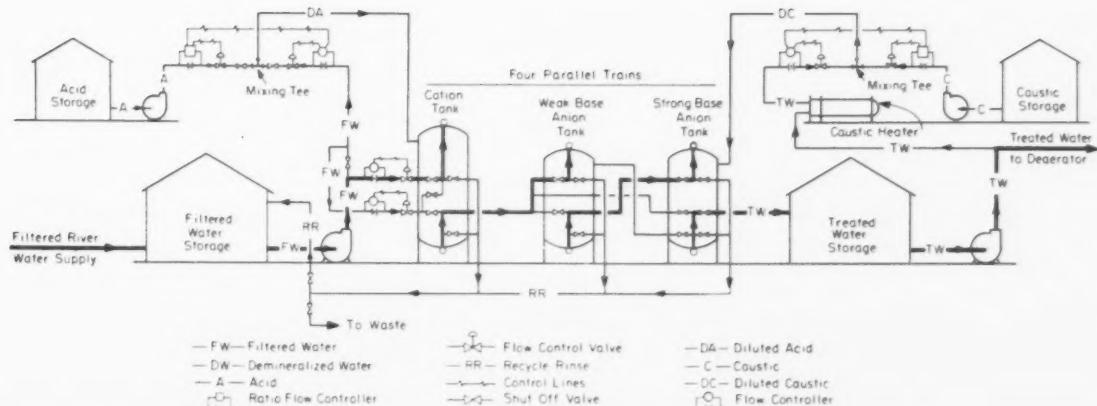
Consulting Engineers



ELECTRICAL CONTROL CONSOLE AND RELAY PANEL
IN THE CONTROL ROOM OF THE NEW POWER PLANT.

PORT ARTHUR NO. 3 Power Station is a by-product type power plant to supply the additional steam electric power required by new refinery process units. The plant is of the outdoor type consisting of one building enclosing the main boiler-turbine control room and the station service switchgear; one building for the water treating control room, and an open steel structure for supporting piping and grating access walkways. Three, 300,000-lb per hr, gas or oil fired boilers supply steam at 900 psi, 750 F for refinery process requirements and the 15,625-kw back pressure turbine-generator. Pressure reducing stations and the turbine exhaust provide 600 and 150 psi steam to existing refinery headers.

The boiler feedwater normally is filtered river water treated by a 1-million lb per hr, 3-bed, 4-



PROCESS FLOW DIAGRAM OF FEEDWATER TREATMENT PLANT PROVIDING 100-PERCENT MAKE-UP FOR STATION.

train demineralizer plant to a maximum quality of 4 ppm total dissolved solids and 0.5 ppm of silicas. It is occasionally possible that up to 15 percent of the feedwater may be condensate from the refinery. The turbine-generator electrical output is connected to the refinery 33-kv transmission system through a 20,000-kva transformer and the 6-circuit, breaker-and-a-half, 33-kv switchyard. Provision has been made for the addition of 4 boilers and 3 turbine-generators in the future.

The important auxiliaries, except fans and boiler feed pumps, are duplicated with half motor-driven and half turbine-driven units. Two of the four boiler feed pumps and two of the fans are dual-driven for emergency operation. The third fan and the third feed pump are turbine driven and the fourth pump is motor driven. The normal turbine drives use 150 psi steam and exhaust to a 15 psi steam header for feedwater heating when necessary to make up for lack of 15 psi steam from the refinery.

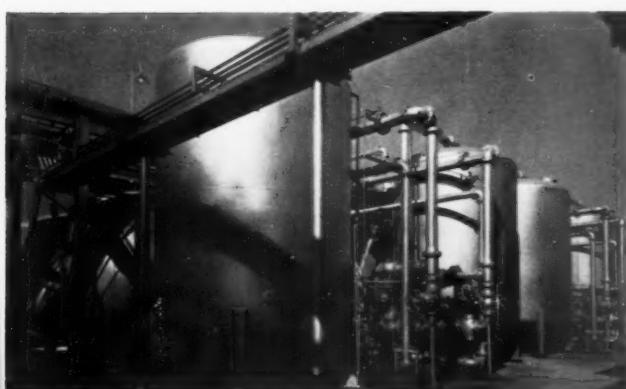
The turbine-generator is weatherproofed and is provided with a walk-in steel housing over the exciter. Large motors are of the weather-protected type and small motors of the totally-enclosed fan-cooled type. The turbines and pumps have weather-proofed lagging.

The boilers and the turbine-generator are started from local start-up panels, but normal operation is through controls on the consoles of the air-conditioned main control room. Large windows allow the operators to view the turbines, boilers, and the switchyard as well as providing ample daylight, which is supplemented by a corrugated plastic luminous ceiling to provide about 50 foot-candles on the control room operating surfaces at night.

Since the plant is built on filled land, 60-ft treated wood piles support the reinforced concrete foundation mats for the boilers, equipment, and pipe supporting steel. Underground piping and conduit was kept to a minimum. Motor leads are run in exposed conduit while control cables are run in cable trays supported by the walkway steel. The generator leads and station service transformer leads are weatherproof 13.8-kv and 5-kv bus duct.

Severe atmospheric contamination required care in selection of materials and in equipment layout to minimize corrosion damage and allow maximum access for maintenance without a full shutdown.

- The three unique features of the plant are:
- The 100 percent make-up water treating plant handling river water.
- The process steam requirement of approximately 500,000 lbs per hr of 900 psi and 600 psi steam and 500,000 lb per hr of 150 psi steam exhausted from the turbine—conditions which called for the large boiler capacity and the large pipe gallery.
- The completely outdoor construction including exposed local start-up panels for the turbine and the boilers.



PHOTOGRAPH SHOWS PART OF THE DEMINERALIZERS USED TO TREAT THE RAW RIVER WATER.



DR. KRICK (CENTER) AND TWO OF HIS ASSOCIATES STUDY WEATHER DATA TO BE FED TO THE UNIVAC.

Here's How Krick Predicts the Weather

STAFF

EVERY CONSULTING ENGINEER has a more than lay interest in the weather. **CE exclusive** The construction industry is controlled considerably by weather conditions, and the engineer handling supervision of construction would be in a much better position if he knew what to expect in the weeks ahead. If he knew with reasonable certainty what days would be suitable for pouring concrete or for foundation work, he could schedule his time much more accurately. Knowing what the weather is likely to be,

he could advise his client and the contractor as to what construction schedules should be set up and the likelihood of meeting schedules that had been established.

Because of the lack of reliable, long-range data, engineers do not realize all of the benefits that can be had from a study of accurate forecasts. If he knew the weather a month ahead, for example, a consulting engineer could advise industrial clients on any number of construction or production activities. If the weather were known 18 months ahead,

precipitation-stream flow relationships and water-year flow curves can be prepared as a basis for streamflow and storage forecasts.

Even in the design and specifications stage, much time and money can be saved by knowing the weather ahead. Effort can be concentrated on those aspects of the job that the weather will permit. A closer estimate can be made of time to be required for field and aerial surveys. And long and expensive trips can be scheduled properly.

Movie Industry Early Client

There is no doubt that the engineer could profit if he knew the weather ahead. But is there any way to know?

Within limits, yes. It is unlikely that man ever will know the weather tomorrow with the same certainty that he knows the weather yesterday, but he can get remarkably accurate weather forecasting not only for tomorrow, but for a month and even a year of tomorrows.

Dr. Irving P. Krick, of Irving P. Krick Associates, Inc., of Denver, has been working on weather forecasting for 25 years. In 1933, when he was head of the Department of Meteorology at California Institute of Technology, he started a private weather service designed to give information to industries dependent on the weather. At first this service was supplied primarily to the movie industry and the West Coast farmers and fruit growers. Gradually the varieties of clients increased until they included oil companies, utilities, advertising agencies, and beverage manufacturers.

Krick's studies while at Caltech brought out three important facts about the behavior pattern of the atmosphere, and it was on these that he based his forecasts for the private weather service. He found that the weather is influenced primarily by the East Pacific High; he found that there are eleven basic weather patterns; and he noted that there is a tendency for recurrence. On this basis he was able to forecast conditions for the D-Day landings in France and the Allied crossing of the Rhine.

Computer Speeds Long-Range Forecasts

The principal difficulty was in the long time required for the calculation in connection with the influential factors. Problems were of the type that would take one man three months to calculate, and by that time not only the forecaster but everyone else was likely to know the weather — unless the forecast was an extremely long range one.

This problem was solved, in November 1956, when Krick, no longer connected with California Institute of Technology but in business for himself in Denver, installed a Remington Rand UNIVAC

120, a high speed electronic computing machine. Then a typical weather problem could be solved in a matter of minutes.

Because of recurring weather patterns, it is most important that the calculations be based upon weather data observed over as many years as possible. Currently punched cards for Krick's computer carry weather data for every day of the past 20 years. This is being extended to 50 years, and the longer the period for which data are available, the more accurate the forecast will be.

The electronic computer takes the appropriate weather data for past years, adds the position of the Pacific High, then takes into account the relation to the eleven basic weather patterns. The answer is as good for 18 months ahead as for a week ahead — and that is remarkably accurate.

Just how accurate are these forecasts? They can be off — way off, but the percentage accuracy is good. City Service Gas Company last winter had Krick estimate degree-days for Kansas City six months ahead. The forecast predicted 3845 degree-days, and the actual figures came to 3945, a miss of only 2.53 percent. Through February (the most critical operating period) the prediction was 3345 while the actual figure was 3348.

Perhaps Krick's finest hour came when the weather cleared on Jan. 21, 1957 to permit fitting inaugural ceremonies for Eisenhower. Krick six weeks before had told the Inaugural Committee that it would rain up until that day, be clear for the inauguration, and then start again with bad weather.

Currently, Krick has a number of engineers and engineer-contractors among his clients. They receive special reports for weather conditions from as little as a day to as much as two years ahead. One engineer saved months of time and thousands of dollars when putting down a cross-county pipeline by knowing which end to start on (good weather) and where to move the crew.

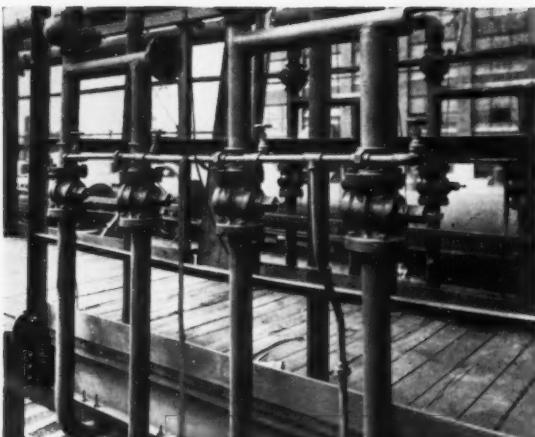
CONSULTING ENGINEER visited Krick late last year and made arrangements for a special forecast designed for consulting engineers. In each issue this forecast will tell our readers what to expect in the month ahead. This is an exclusive CONSULTING ENGINEER service to our readers, available in no other publication. Irving P. Krick Associates can be engaged to prepare special reports and weather studies for consulting engineers. They can supply weather data for any part of North America over almost any long range period and will soon extend their forecasting services to cover Europe. Fees for the service are based upon the extent of data requested. ▲▲

Weather forecast on pages 125-128.



HOW TO JUDGE A LUBRICATED PLUG VALVE

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1 Does it permit full flow?

acf Round or Rectangular Port Lubricated Plug Valves do. In any given size the Round Port Valve has a plug port diameter and area the same size as the pipe. The Rectangular Port, while of different shape, has the same Port area as the inside area of the pipe with which it is used.

2 Does it have quick on/off control?

A quarter-turn (90°) opens or closes **acf** Lubricated Plug Valves. The lubricated, cylindrical plug turns as smoothly and easily as a journal in a bearing.

3 Does it shut-off tight?

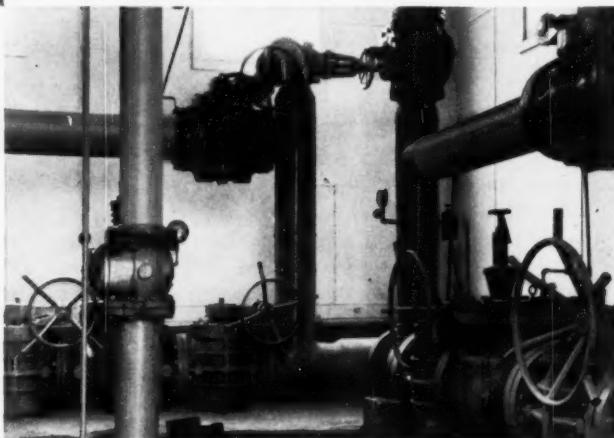
acf Valves have a positive line and stem seal. **acf** Lubricants provide a perfect line seal and Teflon* head gaskets provide a tight head seal. No stem packing is required.

4 What about cost or service?

acf Lubricated Plug Valves stay in service long after their original low first cost has been written-off. They require little or no maintenance. Minimum number of parts and easy dismantling make repairs simple and quick when necessary.

5 Is it corrosion-resistant?

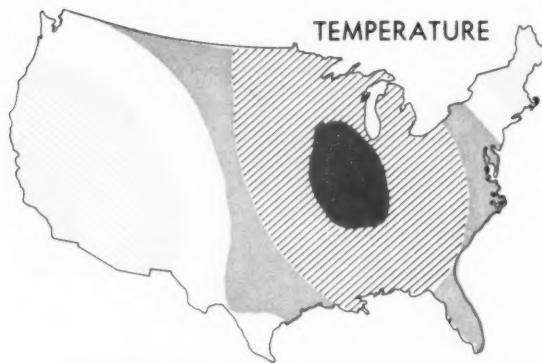
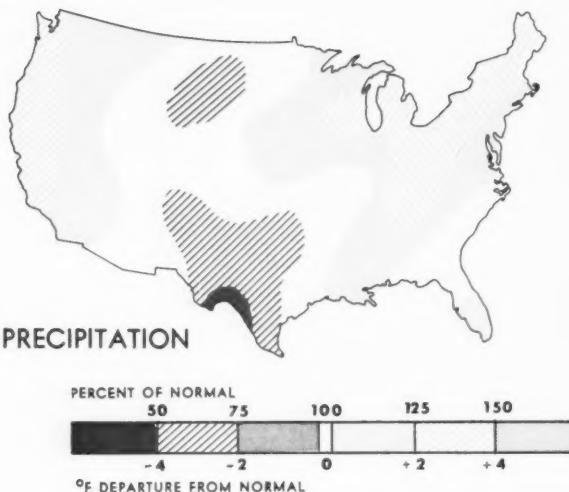
acf Lubricants are available for a wide range of corrosive services. **acf** Valves are available in Semi-Steel, Carbon Steel, Ni-Resist, Bronze and Aluminum.



KRICK WEATHER OUTLOOK

APRIL 1958

Prepared Exclusively for CONSULTING ENGINEER



APRIL HIGHLIGHTS

Best area for construction during April will be in the southwestern portion of the country, where much drier than normal conditions will combine with near normal temperatures to boost the number of potential construction days well above the average. Other than this one dry spot on the weather map, near normal to well above normal precipitation will hamper construction in much of the country.

Up to 50 percent above normal rainfall can be expected through most of Washington, Oregon, and California. In the east, nearly 50 percent above normal rainfall can be expected through Eastern Iowa, Southern Wisconsin, Northern Illinois, Michigan, Ohio, Eastern Kentucky and Tennessee, West Virginia, Pennsylvania, New York, and New England.

Winds in the Great Lakes region early in April will be of considerable force.

While rains in California promise to bring above normal moisture, April rainfall in California is not heavy, and only 3 or 4 days during the month will bring rains of sufficient intensity to halt all work.

Much warmer than normal temperatures can be expected in the West during April, from the Rockies to the Pacific Coast, while east of the continental divide, frequent cool outbreaks sliding down from Canada will tend to keep temperatures from two to four degrees below the seasonal normal.

Poorest construction area in April will cover parts of the Mississippi and Ohio Valleys, the Great Lakes, and Appalachian regions. Heavy rains will be the major factor in causing work shutdowns.

CONSTRUCTION DAY CRITERIA

To be considered a construction day on these charts, the day's maximum temperature must be more than 38 degrees. There must be less than six inches of snow on the ground. There must be less than six hours of active precipitation between the hours of 7 a.m. and 5 p.m. There can be no more than one inch of rain on the preceding day.



TEAR OUT ALONG PERFORATION.

These forecasts are prepared by Irving P. Krick Associates, Inc., the world's oldest and largest weather engineering firm. The forecasts are based on methods developed at California Institute of Technology prior to World War II. After the War, the methods were adapted to high speed electronic computing machines to shorten the time required to solve the complex problems of the atmosphere. Ultra-long range forecasts, up to a year or more in advance, are now available. Information on other Krick weather services is available by writing the home office at 460 South Broadway, Denver, Colorado.

CONSTRUCTION DAYS

APRIL 1958 ESTIMATES

| LOCATIONS | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|-----------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| HIGHEST | 30 | 30 | 30 | 30 | 30 | 29 | 29 | 30 | 29 | 30 | 28 | 30 | 29 | 29 | 27 |
| LOWEST | 25 | 25 | 27 | 25 | 29 | 19 | 12 | 27 | 23 | 26 | 22 | 26 | 20 | 26 | 21 |
| AVERAGE | 27 | 29 | 29 | 28 | 24 | 30 | 24 | 28 | 26 | 27 | 25 | 28 | 25 | 27 | 25 |
| ESTIMATE | 25 | 26 | 27 | 26 | 30 | 22 | 20 | 30 | 25 | 27 | 22 | 26 | 22 | 26 | 21 |

These estimated construction days for key cities in the United States should be interpreted as an average of estimated conditions over the forecast area. To obtain the best results, the forecast number of construction days should be compared with the temperature and precipitation anomaly maps and the timing estimates to determine the probable number of construction days in your locality. The forecast construction days are based on average construction day requirements as defined under "Construction Day Criteria," and should be adjusted in keeping with individual operation.

MAY AVERAGE AND RANGE*

| LOCATIONS | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|-----------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| HIGHEST | 30 | 31 | 31 | 31 | 31 | 30 | 31 | 31 | 30 | 30 | 31 | 31 | 30 | 31 | 30 |
| LOWEST | 22 | 29 | 28 | 28 | 30 | 19 | 25 | 28 | 25 | 25 | 25 | 26 | 23 | 28 | 23 |
| AVERAGE | 28 | 30 | 31 | 29 | 31 | 27 | 29 | 29 | 28 | 27 | 28 | 28 | 26 | 30 | 26 |

JUNE AVERAGE AND RANGE*

| LOCATIONS | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|-----------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| HIGHEST | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| LOWEST | 25 | 28 | 29 | 27 | 29 | 26 | 24 | 28 | 24 | 27 | 26 | 27 | 24 | 26 | 23 |
| AVERAGE | 28 | 29 | 30 | 29 | 30 | 28 | 27 | 29 | 27 | 29 | 28 | 28 | 27 | 28 | 26 |

*Historical Average, Not a Forecast

APRIL 1958 TIMING OF SIDEWINDS

| WASHINGTON OREGON | PRECIPITATION | | | | | | | |
|----------------------|---------------|---|---|----|----|----|----|----|
| | DAY OF MONTH | 1 | 5 | 10 | 15 | 20 | 25 | 30 |
| | TEMPERATURE | | | | | | | |

Best construction period during April will occur during warm, storm-free period between 19th and 24th. Cold outbreak following 25th will be felt primarily to the east.

| IDAHO - MONTANA WYOMING | PRECIPITATION | | | | | | | |
|----------------------------|---------------|---|---|----|----|----|----|----|
| | DAY OF MONTH | 1 | 5 | 10 | 15 | 20 | 25 | 30 |
| | TEMPERATURE | | | | | | | |

Warm, storm-free period between 9th and 13th should offer best construction weather. Most severe cold will occur during cold outbreak around the 5th and following the 15th.

| CALIFORNIA NEVADA | PRECIPITATION | | | | | | | |
|----------------------|---------------|---|---|----|----|----|----|----|
| | DAY OF MONTH | 1 | 5 | 10 | 15 | 20 | 25 | 30 |
| | TEMPERATURE | | | | | | | |

Storm periods indicated will affect mostly Northern California and Northern Nevada. Precipitation from storms in southern portions will be light and relatively unimportant.

| ARIZONA - UTAH COLORADO NEW MEXICO | PRECIPITATION | | | | | | | |
|--|---------------|---|---|----|----|----|----|----|
| | DAY OF MONTH | 1 | 5 | 10 | 15 | 20 | 25 | 30 |
| | TEMPERATURE | | | | | | | |

Timing shown here is primarily for areas west of the continental divide. Eastern Colorado and New Mexico can expect a cool outbreak and freezing temperatures between the 3rd and the 5th.

| MINNESOTA N. & S. DAKOTA | PRECIPITATION | | | | | | | |
|-----------------------------|---------------|---|---|----|----|----|----|----|
| | DAY OF MONTH | 1 | 5 | 10 | 15 | 20 | 25 | 30 |
| | TEMPERATURE | | | | | | | |

Cold outbreaks indicated will not be severe, but frequently will tend to keep daytime maximums below operational minimum. Storminess following 15th will be intermittent.

| NEBRASKA KANSAS IOWA - MISSOURI | PRECIPITATION | | | | | | | |
|---------------------------------------|---------------|---|---|----|----|----|----|----|
| | DAY OF MONTH | 1 | 5 | 10 | 15 | 20 | 25 | 30 |
| | TEMPERATURE | | | | | | | |

Cold outbreaks during first ten days will be most severe. Temperatures during warm periods will frequently rise into 70's. Precipitation mostly rain, occasionally mixed with snow.

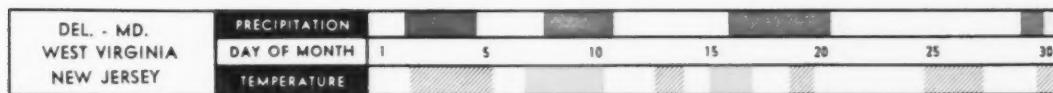
| WISCONSIN MICHIGAN-INDIANA ILLINOIS - OHIO | PRECIPITATION | | | | | | | |
|--|---------------|---|---|----|----|----|----|----|
| | DAY OF MONTH | 1 | 5 | 10 | 15 | 20 | 25 | 30 |
| | TEMPERATURE | | | | | | | |

Strong winds can be expected during precipitation period at start of month. Storminess around 10th mostly Lake Superior region; that following mid-month mostly in Ohio Valley.

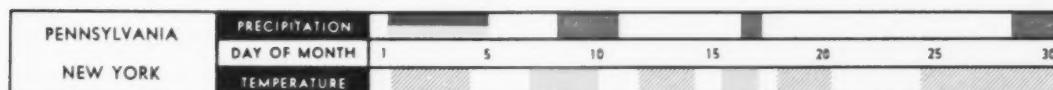
OF SIGNIFICANT WEATHER EVENTS

| | |
|------|--|
| RAIN | |
| SNOW | |
| WARM | |
| COLD | |

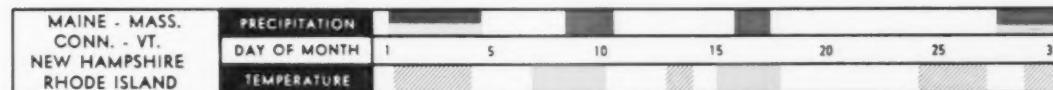
The timing bars below are intended to indicate periods of important general storminess and important departure from temperature **normals** in areas indicated. They are highly accurate over the area indicated, but are too general to pinpoint small local storminess or showers. Allow one day on either side of indicated storm or extreme temperature periods for general planning. Combination rain or snow shading indicates either one or both.



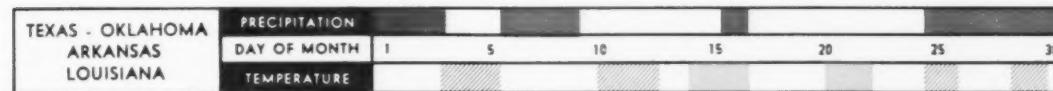
Cool outbreaks indicated will not be severe, but overnight minimum temperatures occasionally will be near freezing in inland areas. Temperatures will be warmer near the coast.



Precipitation during early month storm will be mostly rain, with snow at higher elevations. Cool outbreaks will not be severe but a reflection of low daytime temperatures.



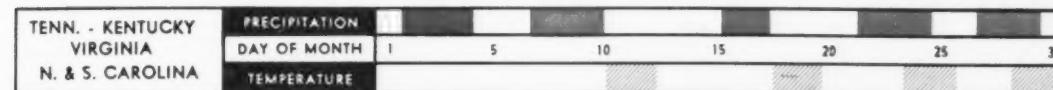
Indicated rain-and-snow periods apply mostly to mountain areas. Lower elevations can expect rain. Warm periods indicate mild, rather than extremely warm temperatures in this area.



Early-month storminess will affect mostly Oklahoma, Northern Arkansas, and the Texas panhandle. Stormy period at month's end will be mostly in the form of intermittent showers.

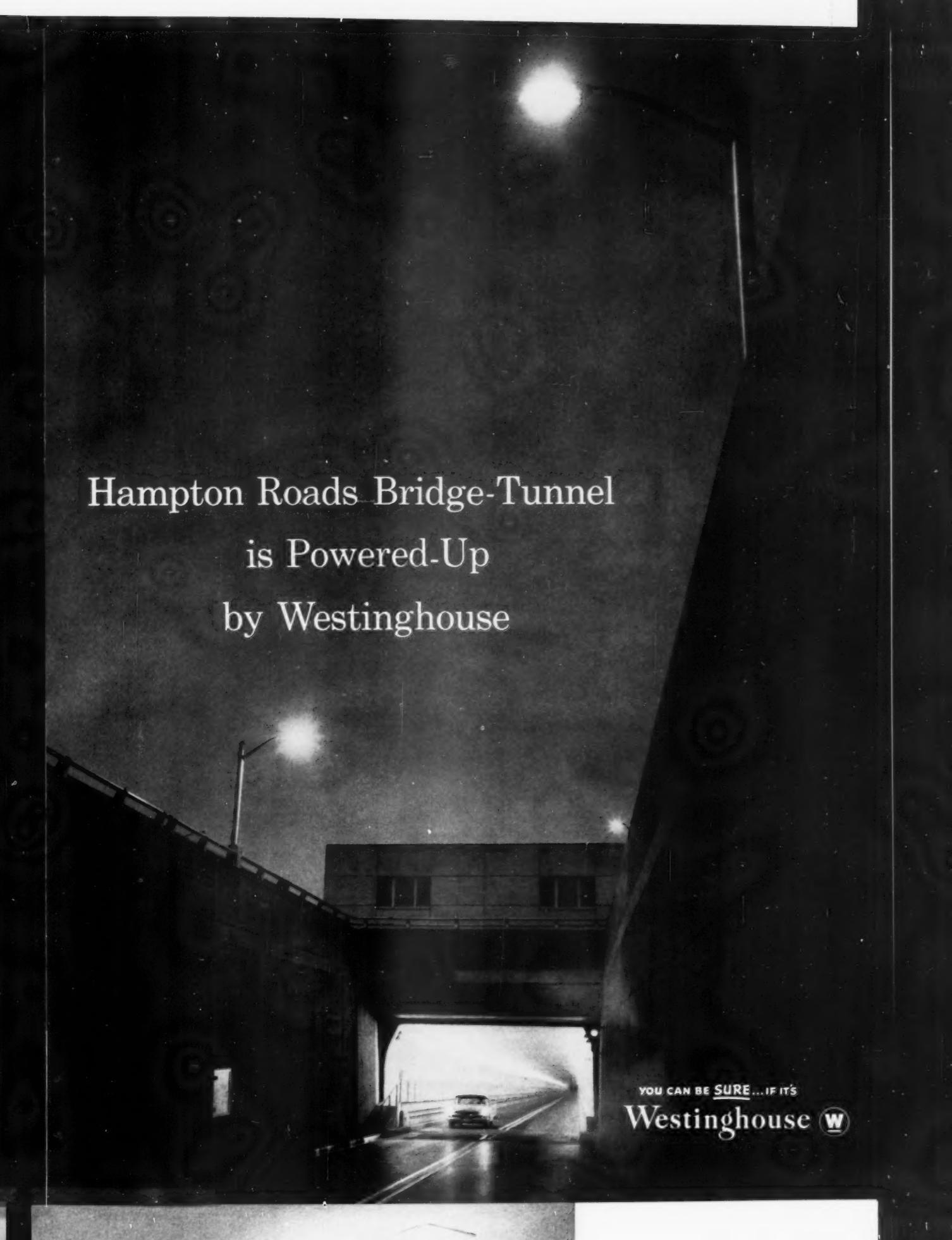


None of the indicated cold outbreaks will drop temperatures as low as freezing, but cloud conditions during these days will keep daytime temperatures below normal for area.



Most important cold outbreak will follow 10th of April, with other indicated cold periods just below normal. Periods between cool outbreaks generally will feature mild temperatures.





Hampton Roads Bridge-Tunnel
is Powered-Up

by Westinghouse

YOU CAN BE SURE...IF IT'S
Westinghouse 

Hampton Roads Bridge-Tunnel Links Virginia Peninsula with Norfolk

Westinghouse Electrical Equipment is Used Throughout

The bridge-tunnel recently opened across Hampton Roads, between Newport News and Norfolk, Virginia, features many "firsts" in engineering and construction. Among the most interesting of these are the specially engineered uses of electrical power for illumination, ventilation and other required services.

Both bridge and land approaches to the new 7,479-foot portal-to-portal tunnel are lighted with Westinghouse OV-20 mercury vapor luminaires, controlled from the central control panel. The interior of the tunnel is lighted with special Westinghouse fluorescent luminaires—employing enough fluorescent tubes to provide a single uninterrupted light line three miles long. Double rows of these fixtures provide high-intensity lighting at the tunnel portals, while the central portion of the tunnel uses a single row of lights on each side. Lighting intensities at both tunnel openings are controlled in relation to the daylight or darkness outside,

so no abrupt visual adjustments to varying light conditions are required when entering or leaving tunnel. Special Westinghouse saturable reactors and controls were developed to provide this important lighting technique. The entire length of tunnel is so well illuminated that motorists will be able to switch off their lights while driving through it.

Special Westinghouse equipment controls sixteen vane-axial ventilating fans, eight at each end of tunnel, with a total circulating capacity of 3,408,000 cubic feet of air per minute. Eight fans supply fresh air to tunnel while the other eight exhaust contaminated air. Pitch of fan blades is variable and remotely controlled to permit accurate regulation of air volume handled by each fan. All fan operation is coordinated and controlled at central control board where four carbon monoxide recorders provide a constant check on the concentration of this gas throughout entire length of tunnel.

The entire electrical power requirement of tunnel

(cont'd.)

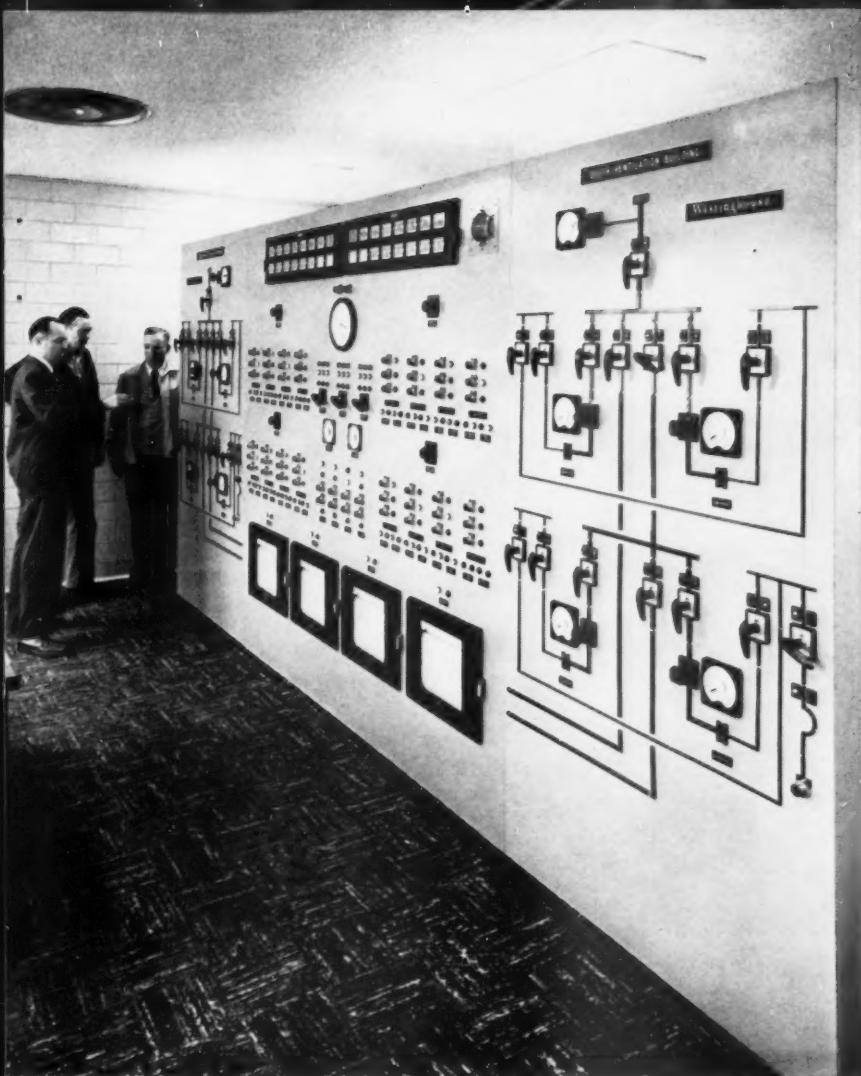


Tunnel is lighted with special Westinghouse fluorescent luminaires installed in protective tubes of pyrex glass. Special bronze fixtures were provided by Westinghouse to mount lights and protective tubes and to facilitate cleaning and replacement.



Intensities of tunnel lighting are varied by means of saturable reactors. Also included in installation are lighting supply transformers and constant current regulators to control bridge and approach lighting. View of transformer room shows John L. Taylor of E. C. Ernst, Inc., Electrical Subcontractors and Engineers, and William G. Phillips, Westinghouse Service Engineer.

J-94089-2



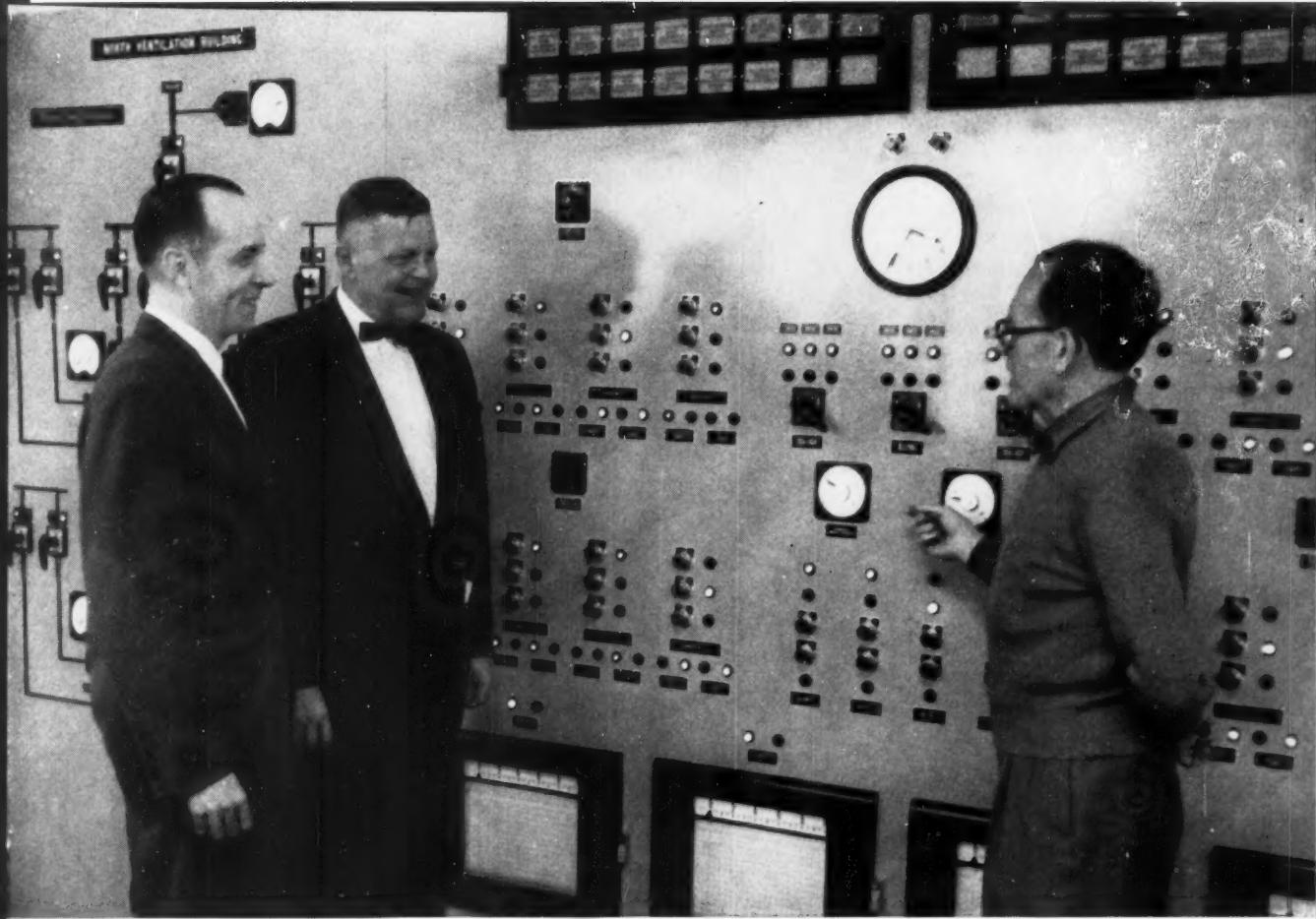
A Westinghouse special master tunnel control board allows operator to supervise tunnel operation from central point. Both tunnel illumination and ventilation are controlled from this board. Ventilating rates can be adjusted by varying number of supply and exhaust fans in operation and by changing fan speed and blade pitch to increase or decrease fan capacities. Also incorporated are alarm indicators, carbon monoxide recorders, time switches and other indicating and control devices. M. B. Trimble, Westinghouse Construction Sales Engineer; James McMahan, Bridge-Tunnel Superintendent, Virginia Department of Highways; and Harry D. Mahoney, Engineer, Parsons, Brinckerhoff, Hall and Macdonald, Consulting Engineers, discuss control board.



Westinghouse double-ended power centers utilize 1000-kva Inerteen®-immersed power transformers. Incoming power service enters metal-clad switchgear located between step-down transformers. Close-coupled to transformer secondaries are low-voltage switchgear assemblies, special fan control cubicles and control centers for tunnel auxiliaries.

J-94089-3

**YOU CAN BE SURE...IF IT'S
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Close-up of center of tunnel control board shows M. B. Trimble, Westinghouse Construction Sales Engineer, with Maurice N. Quade and J. O. Bickel of Parsons, Brinckerhoff, Hall and Macdonald, Consulting Engineers, Designers and Supervisors.

is supplied through four identical Westinghouse 2000-kva power centers, two in each ventilation building on man-made islands at each end of tunnel.

This is another example of how Westinghouse can help engineers and contractors satisfy electrical distribution requirements. For information apply-

ing to your specific needs, see your Westinghouse electrical construction engineer. Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa.

J-94089-4

YOU CAN BE SURE...IF IT'S **Westinghouse**

Bridge approach to south end of Hampton Roads Tunnel. Illumination for both approaches is provided by Westinghouse OV-20 mercury vapor luminaires controlled by time switches and photoelectric relays.

Owner: Commonwealth of Virginia—
Department of Highways

Consulting Engineers: Parsons, Brinckerhoff,
Hall and Macdonald

General Contractors: Merritt-Chapman &
Scott Corp.

(Approach bridges, portal islands,
cut-and-cover sections, underwater tunnel)

Tidewater Construction Corp.
(Portal approaches, ventilation buildings,
mechanical and electrical work)

Electrical Subcontractors: E. C. Ernst, Inc.

Over 250 Pages
Westinghouse Data
in Sweet's Construction File.



Report from Belgium

JOHN ASHTON
Consulting Engineer Correspondent

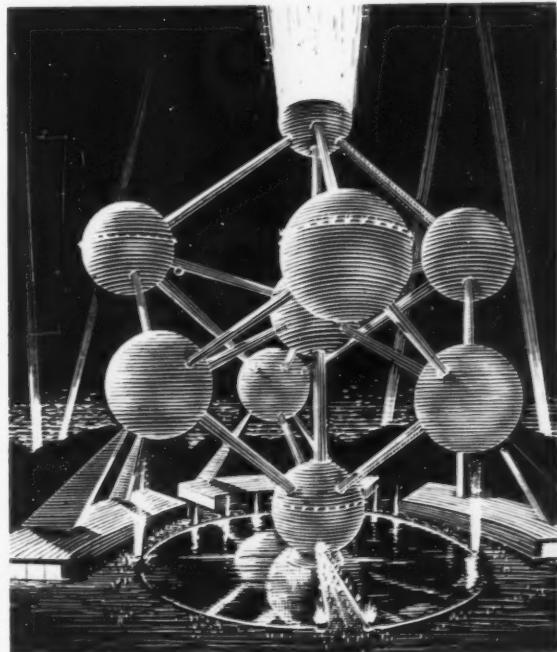
IN ALL MATTERS of policy formulation and organization, Belgium's small group of consulting engineers are progressive, dynamic, and proudly independent. Their association — Chambre des Ingénieurs Conseils de Belgique (CICB) — was founded in 1909. President of the 100-member organization is one of the country's leading engineers, A. Tourne, of Brussels.

The most important membership qualification requires members to exercise their profession objectively, without consideration for outside business interests. Belgian consulting engineers must, Tourne states, remain absolutely independent as far as suppliers or contractors are concerned, and can accept no compensation that might compromise the impartiality of their judgment. The rules controlling admission to the association also state that members must have a university degree — engineers with a technical college degree are not accepted — and they can under no circumstances be permanently attached to any outside firm or government agency.

"We have no formal code of ethics — we do not need one!" Tourne says. "The rules outlined in the statutes of the association are sufficient and they determine conditions for inquiries and fees. The legal foundation of our association has been set in cooperation and agreement with the Belgian Federation of Engineers, which groups all associations of the colleges and universities such as the Association of Engineers of Louvain University, the Association of Engineers of Brussels University, and the Association of Engineers of Royal Military College. The Federation has 14,000 members, of which 100 are recognized consulting engineers authorized to carry that title."

By tacit gentlemen's agreement, consulting engineers observe certain rules, and violators of professional ethics are expelled from the association.

CE exclusive



"We are proud to say," Tourne emphasized, "that this has never occurred."

The Association bases its fees upon rules determined by the Federation. Since consulting engineers in Belgium are "Class I Experts," fees are set at the following rates:

| Project Cost U.S. Dollars | Fee — Percent of Project Cost |
|------------------------------|----------------------------------|
| \$ 2,000 | 6.70 |
| 4,000 | 6.15 |
| 6,000 | 5.90 |
| 40,000 | 3.95 |
| 60,000 | 3.50 |
| 200,000 | 2.90 |
| 1,200,000 | 2.40 |

For projects over \$1,200,000, commissions are set by special agreement between engineer and client.

These commissions are broken up into six or more parts depending on whether the engineer's work is to be "complete" (advice and execution from beginning to end), "partial," or of "limited objective."

However, most Belgian engineers vary these commissions by agreement with their clients while respecting the general schedule as a whole.

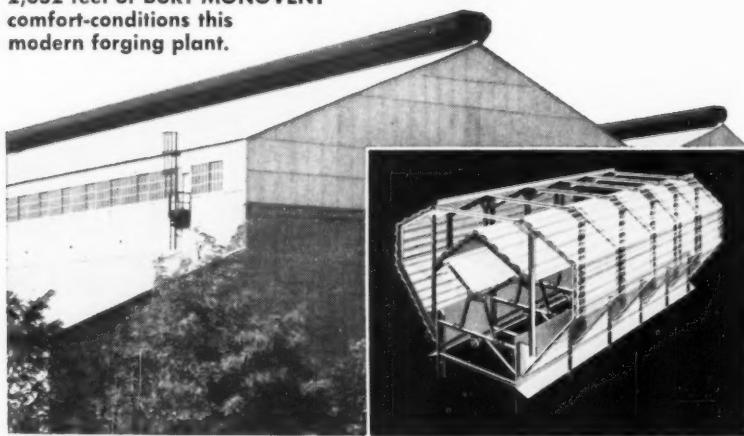
Control of the Word "Registered"

One point on which the Association is extremely touchy is abuse of the word "registered" with reference to an engineer. The term is employed nationally only to denote a consulting engineer. According to law, architects and civil engineers



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trained at one of the five Belgian universities must be registered individually in each of the nine Belgian provinces, and architects and engineers have equal rights. That means that consulting engineers can sign their plans as architects or as engineers.

There is no special government license or authorization. Their university degree carries full legal weight, being protected by a parliamentary bill of 1933, under which no one with only college or technical high school training in Belgium can put the word "engineer" in front of his name.

"This bill was an absolute necessity," a spokesman for the Association said, "for we had plumbers who put on their doors and visiting cards 'sanitary engineer.'" When such violations of the law are discovered, and certain persons still abuse the title, the guilty party is taken to court and generally fined. Engineers with other than university training may put "Ingenieur Technicien" on their cards, but nothing else.

Not only do Belgian engineers work in their own country and the Belgian Congo — where there are only three firms of consulting engineers and most engineering work is handled by the government — but they often are consulted by foreign firms and governments. They have worked in Latin America, they have built dams in Colombia, and one firm even has its own offices in Madrid and Cairo.

Belgian consulting engineers are extremely interested in developing their profession and having a share in work now being done in underdeveloped areas. Last year they participated in the founding of an international group of consulting engineers with the home office at The Hague. Their great regret is that American engineers are not yet affiliated with this organization.

There has been some competition from foreign consulting engineers working in Belgium, but not enough to worry about. Certain

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| 56 | Automatic Combustion Controls | 69 | Steam Jet Refrigeration System |
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private companies employ foreign engineers. A few years ago a sugar-producing company in the Kivu (Belgian Congo) used foreign services, and work on plantations belonging to a major Belgian financial concern was entrusted to a Dutch consulting engineer group, mainly because of its experience in irrigation and organization gained in Indonesia.

Belgian engineers also have collaborated with U.S. engineers in Africa. One of the examples cited frequently is the collaboration between Belgians and Americans during the study of the Leopoldville sewer system. The design work itself has been undertaken by a Belgian bureau alone.

One of the major Belgian firms is the Compagnie Africaine, a planning bureau composed of several independent engineers. They already have helped in the construction of 600 miles of new roads, 29 bridges, and the regulation of the Kivango River and Kingushi dam in the Congo. Today they are one of the four firms engaged in the preliminary work over the famous Inga project, the others being engineering groups set up by large corporations directly interested in the project.

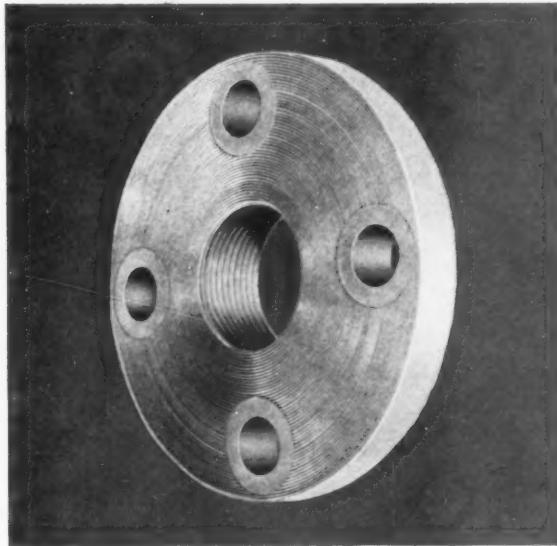
To Exhibit in Brussels

Belgium's consulting engineers, having grouped together, also will be participating in the Universal and International Exhibition in Brussels this year. Under the name "Group 42" they will have an exhibit inside the Belgian technical pavilion explaining to the domestic and foreign visitors the work of consulting engineers in general, as well as special study, control, and statistical organizations. This participation is all they wish to do in the field of public relations, for they believe that their technical abilities and known integrity as objective and independent advisers are sufficient to maintain the very high standing of their profession in Belgium and in Europe. □

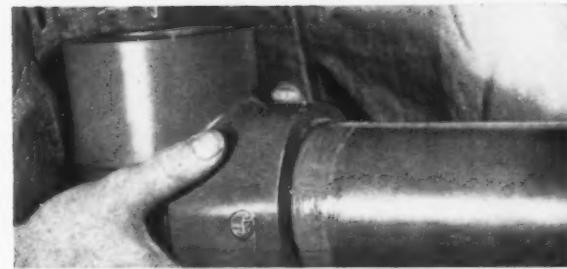
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In preparation for the dome erection, a 20-inch pipe pole with a 48-inch diameter plate top was erected and plumbed. The spider or top section of the dome, which is about 11 feet in diameter, was then placed on top of the pole and bolted down.

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BECAUSE OF THE GROWING importance and widespread application of radioisotopes in industry, consulting engineers will be interested in a report by the Council for Technological Advancement of Machinery and Allied Products Institute.

This report shows that industry is increasingly aware of the potential gains radioisotopes offer in cost savings and improved product quality. Industrial users of radioisotopes have increased from 18 in 1946 to 1667 in 1956. This increase is the result of proven cost savings resulting from known applications, and increased production facilities for artificial radioisotopes — particularly Cobalt 60. Small business as well as large business is using this new tool safely and economically to increase the quality of products while reducing costs. Radioactive isotopes do a job that could not be done before, do a better job, or perform a job more economically.

It is estimated that the market for thickness gages alone is less than 10 percent saturated, in spite of the fact that most applications of these gages produce savings equal to their cost within a year or less. From this one use alone the Atomic Energy Commission estimated industrial savings of \$18.5 to \$27.8 million in 1956.

Estimated savings in other industrial applications brought the total for 1956 to perhaps \$400 million. The savings should continue to grow as new applications are discovered and the number of present applications multiplies.

To support the increasing number of users and applications, there is a necessity for increased radioisotope production. Currently nearly 100 private

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JOHN F. LEE

Distinguished Professor and Graduate Administrator
North Carolina State College

The Challenge of Atoms in Action

firms are engaged in processing and redistributing radioisotopes, and isotope production about equals demand; further expansion depends on extensive development of the isotope market.

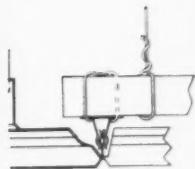
Already radioisotopes are used in a wide variety of industries, and an apparently unlimited number of uses still remain to be discovered or made commercially available. Current uses include:

- Industrial research — irradiated tools or parts for measuring wear of such items as cutting tools, pistons, or wiredrawing dies.
- Radiography — a substitute for X-rays for inspecting steel castings or welded joints.
- Gages — to measure and control the thickness of steel, paper, paint, rubber, and other products.
- Tracers — to determine liquid flow as in a pipeline, the transfer of printing ink, or the thoroughness of paint mixing.
- Ionizers — to eliminate static electricity in textile and paper production.
- Polymerizers — catalysts to speed or initiate chemical reactions.
- Radiators — low-intensity light sources for exit signs, storage bins, or traffic lane markers.

Industrial Research

Accurate measurement of metal wear is important to many industries. Machinery manufacturers, for example, are interested in measuring the wear on cutting tools and wiredrawing dies. The automotive industry wants to determine the useful life of breaker points, piston rings, and connecting rods. The oil industry seeks an oil with superior antifrictional properties.

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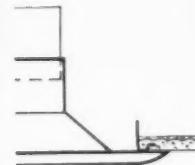
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tion or anticorrosion properties. Because of the time consumed in such tests and the high costs of labor and materials, a rapid and accurate method of wear measurement is extremely valuable in many industrial processes.

Formerly, parts to be tested were carefully measured or weighed, then installed in a test machine. After running for several hours or even days, the machine was dismantled and the parts carefully measured to determine the wear. To obtain significant measurements lengthy runs were necessary.

With the radioisotope method, parts are bombarded by neutrons in a reactor, making them slightly radioactive. These parts then are assembled in the test equipment. Any radioactive metal worn off when the machine is running is detected readily by a radioactivity counter. Measurements can be made without dismantling the equipment. The sensitivity of this method is so high that wear can be determined in the first few minutes of running time.

Radioisotopes can slash time requirements for tests by 75 percent or more, and material and labor costs by as much as 90 percent. Many companies have not only saved thousands of dollars, but have achieved far more accurate results by using these new methods.

Industrial Radiography

Radioisotopes can find voids and cavities in castings or finished products without destroying the sample. A radiation source is placed on one side of the part and a photographic film on the other. After exposure the film is developed and interpreted.

Applications generally fall into three categories: where there are a large number of pieces to be inspected (chain links or hooks); where the size or complexity of the work is unusual (distilling columns); or where the work is in an isolated location (pipelines).

Radium and X-ray machines have been used for nondestructive testing for years, and the techniques of use have been highly developed. Under certain conditions, however, the cost of an X-ray machine or purchasing or renting radium capsules may be a deterrent — particularly when used infrequently.

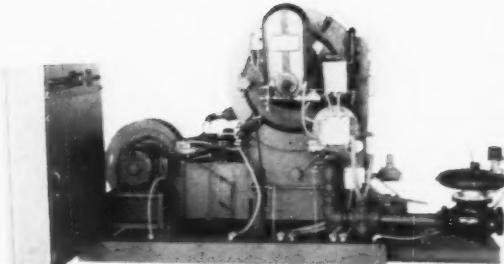
Currently some 500 organizations use radioisotopes as X-ray replacements. Cobalt 60, Cesium 137, and Iridium 192 are used for tests on lead, steel, and iron castings. Cobalt 60 sources provide gamma rays comparable to a million-volt X-ray machine, which costs approximately \$100,000.

One commercial supplier of isotope equipment offers portable radiography equipment in a price range from \$1600 to \$15,000, depending on the power. Isotopes are additional, ranging from \$200 for 5 curies of Cobalt 60 to \$7400 for 100 curies. Energies from these amounts will penetrate from $\frac{3}{4}$ to

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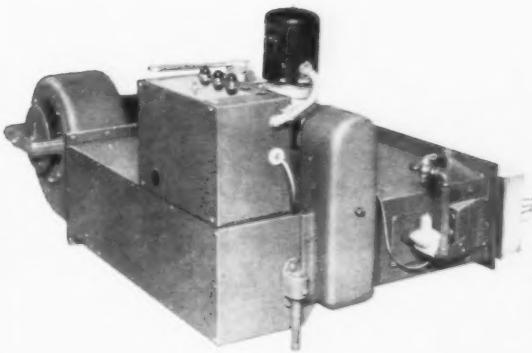


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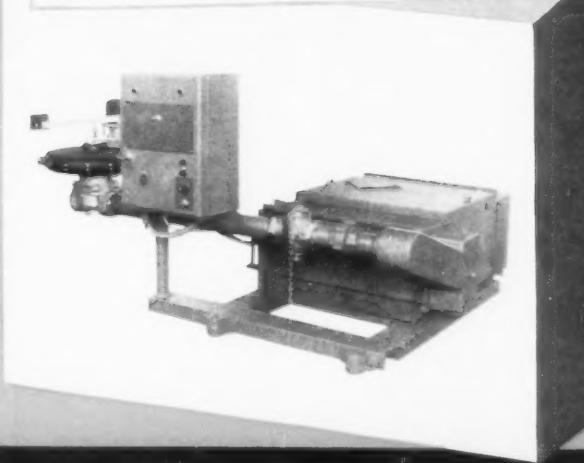
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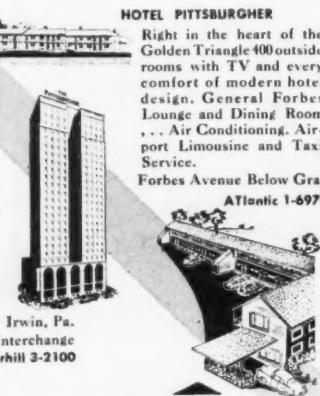
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10 inches of steel. A complete installation capable of penetrating 4 inches of steel costs about \$2500.

Radioisotope gages mean improved quality control and decreased costs, with fewer rejections and shutdowns. Formerly, it was necessary to stop production, remove a sample of the material, then carefully measure or weigh it to determine whether the production machinery was in proper adjustment. Radioisotopes can automatically measure and control the thickness of sheet aluminum, copper, tin plate, plastics, rubber, glass, and paper. And because there is no mechanical contact between the gage and the material, continuous high-speed measurement is possible, without damage to material.

Material is run between a radiation source and a detection device. If more or less than a predetermined amount of radiation is detected, the machine can be corrected automatically, or it may be turned off until the adjustments are made. Tolerances of from 0.5 to 2.0 percent can be maintained.

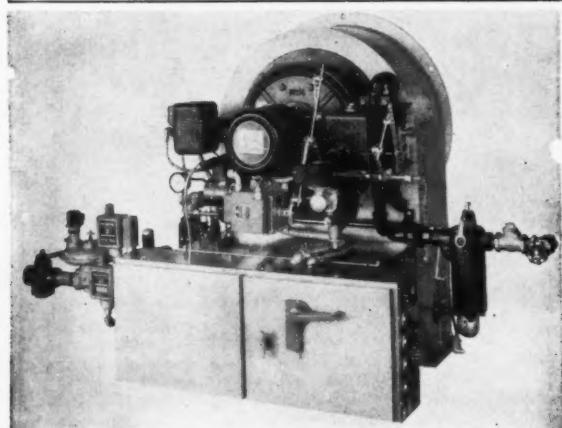
Radioisotope soil moisture and density gages are used in the field to eliminate delays of laboratory testing. They are used to select suitable sites for factory buildings and highway roadbeds. These gages use a radioactive source, a radiation detector, and an electric recorder. The source and detector are housed in a probe which is lowered through a 1-inch diameter steel tube driven into the ground. The source is Cobalt 60 inserted in the probe tip; the detector is a Geiger counter mounted in the top of the probe and shielded against direct radiation. Gamma rays from the Cobalt 60 bombard the soil around the tube, and are scattered by it. The amount of reflected radiation measured by the detector can be translated directly into soil density in pounds per cubic foot. A similar device with a neutron source which measures soil moisture content is available commercially.

Industrial Tracing

Radioactive isotopes in liquids can trace flow in hidden or difficult locations. For example, a single-story factory had copper tubes buried in a concrete floor to provide radiant heating. Attempts to locate a suspected leak by conventional methods had failed. An engineering laboratory suggested adding 1 to 2 millicuries of Iodine 131 to the water in the heating system. Then the floor was explored with a Geiger counter. The leak was pinpointed by a high reading. Instead of having to tear up the entire floor, only a 6-inch section was removed.

Ionization

Static is a problem in many industrial processes. This static can cause severe difficulties in processing and handling. In the printing industry, the paper builds up static charges. Sometimes the sheets repel



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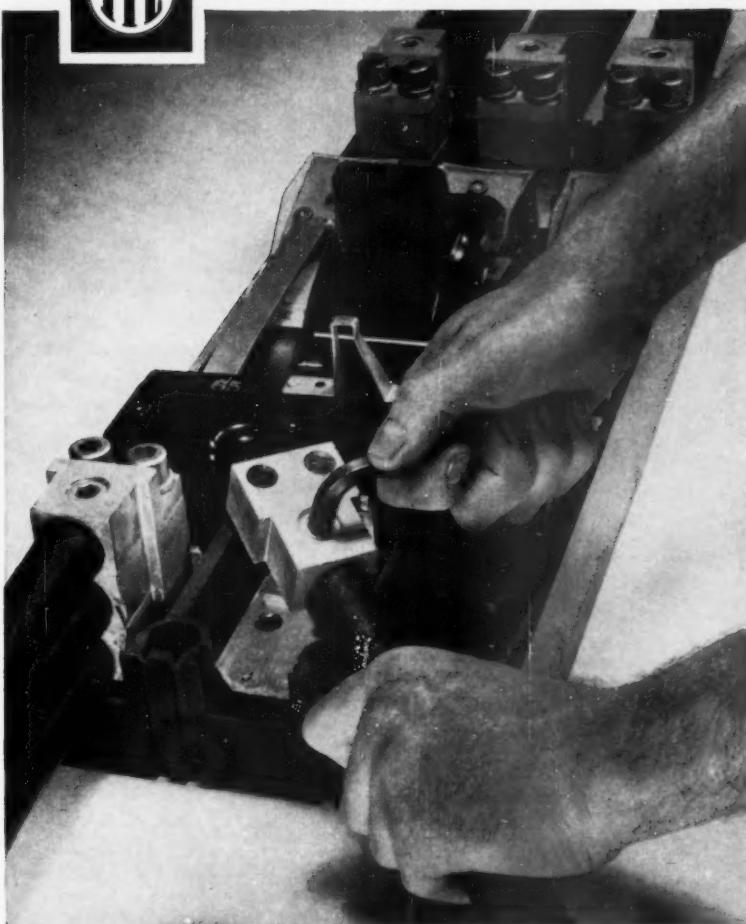


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MOLDED CASE CIRCUIT BREAKERS



These individual cable lugs, each with an Allen head locking bolt, make connection of cables far easier and provide a much sturdier, neater assembly. An exclusive on all I-T-E 800 ampere breakers. UL approved for service entrance equipment.

SEVERAL EXCLUSIVE I-T-E FEATURES COMBINE TO SAVE YOU MONEY WHEN INSTALLING CIRCUIT BREAKER EQUIPMENT

In designing molded case circuit breakers for higher capacities, for example, I-T-E design engineers recognized that the difficulties inherent in making large multiple cable connections had to be considered. Pictured above is their solution—"stacked" lugs for time-saving installation. No need to fight clumsy, unyielding cables.

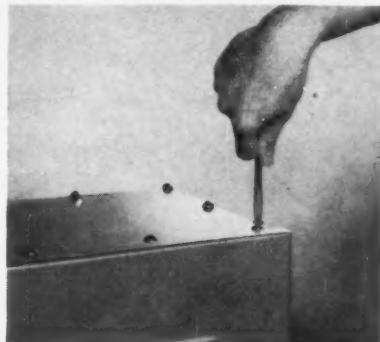
I-T-E enclosures, too, have exclusive, built-in features which greatly facilitate installation of circuit breaker equipment—saving additional installation time. And since time is certainly money these days, consider the time-saving features pictured here and you'll see how I-T-E can save you money even before your I-T-E breakers are in service! I-T-E



I-T-E enclosures are side-hinged—no need to remove, or prop up, the cover. It is nevertheless easily removed, the hinge being of the pin-and-socket type—lifts off and on readily.



Field checks indicated that the addition of a supporting bracket would be a big help in installing larger breakers, and this feature is now added on all large-size enclosures.



To facilitate drilling holes of the desired size and position, end-plates of larger enclosures can be unscrewed and removed. Drill to your exact conduit needs.

Circuit Breaker Company, Small Air Circuit Breaker Division, 19th & Hamilton Sts., Philadelphia 30, Pa. In Canada: Eastern Power Devices Ltd., Port Credit, Ont.



I-T-E CIRCUIT BREAKER COMPANY
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Sun Chemical Corporation

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each other; other times they attract. Either way it is difficult to handle the paper.

A radioactive static eliminator ionizes the air surrounding the paper, allowing the static charge to be bled off. The static eliminator is merely a bar of metal holding a foil of radioactive material. The ionizing radiation is directed toward the static-charged material and is shielded in other directions.

Polymerization

Vulcanizing an automobile tire without using sulphur or heat presages applications of radioisotopes in still another area. It soon may be possible for a company to have its own portable vulcanizing machines to repair conveyor belts and other rubber products in the plant. Other similar applications for isotopes are in research and development phases.

Radiators

Using isotopes with five or more years of half-life, paints have been developed which give off a low-intensity light and can be used as semipermanent markers. Because of the harmful effects of long-life beta and gamma radiators, the paint must be covered with a plastic film which stops the harmful rays but allows the light rays to pass.

Licensing Requirements

The uses of by-product isotopes all are covered by general or specific licenses. No security clearance is needed. The Atomic Energy Act of 1954 issues everyone a general license and no application to the AEC is required. Anyone may purchase small quantities of radioisotopes directly from a distributor or commercial supplier.

A specific license is required for all by-product material not exempted by the general license. Applicants fill out form AEC 313 and submit it to the AEC isotopes extension, Oak Ridge. The proposal is given a hazards evaluation covering the applicant's responsibility, competence, equipment, facilities, and administrative procedures to assure safe use of the nuclear materials.

Safety Requirements

Hazards arising from the use of isotopes vary according to the intensity of the radiation source. The protective equipment needed will depend on the amount of radiation and also on the type (alpha, beta, gamma) of radiation used. Commercial suppliers of isotopes also supply the protective devices needed, along with sufficient instruction for operators to meet minimum AEC licensing requirements. In addition, completely portable radiography equipment, including protective devices, can be operated by plant personnel with a few hours' or days' instruction.



A
REPORT
TO
OUR
CUSTOMERS

Roots-Connersville Expands Production Facilities To Serve You Better



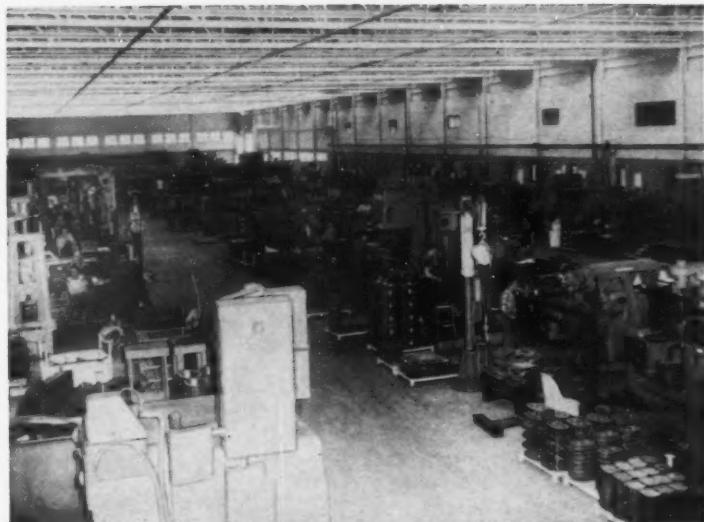
Rotary
Positive
Displacement
Gas Meters



Type XA
Gas Pumps



Type AF
Blowers



To provide the quickest possible delivery for its customers, Roots-Connersville Blower, Division of Dresser Industries, Inc. has just completed a major expansion of its main plant. A completely integrated manufacturing department occupying a 100 x 400 foot area, this addition has expanded plant capacity by 100% for the production of type AF Rotary Positive Blowers, type XA Rotary Positive Gas Pumps and Rotary Positive Displacement Gas Meters.

The new facility is equipped with the most modern, automatic metal-working machinery to provide the utmost precision in machining and assembly operations. Representing a large investment, this equipment is your continuing assurance of high quality in Roots-Connersville products.

As rapidly as possible, a stocking program will be put into effect for all products manufactured in the new department. This program will serve to speed delivery and improve service for all customers.



ROOTS-CONNERSVILLE BLOWER

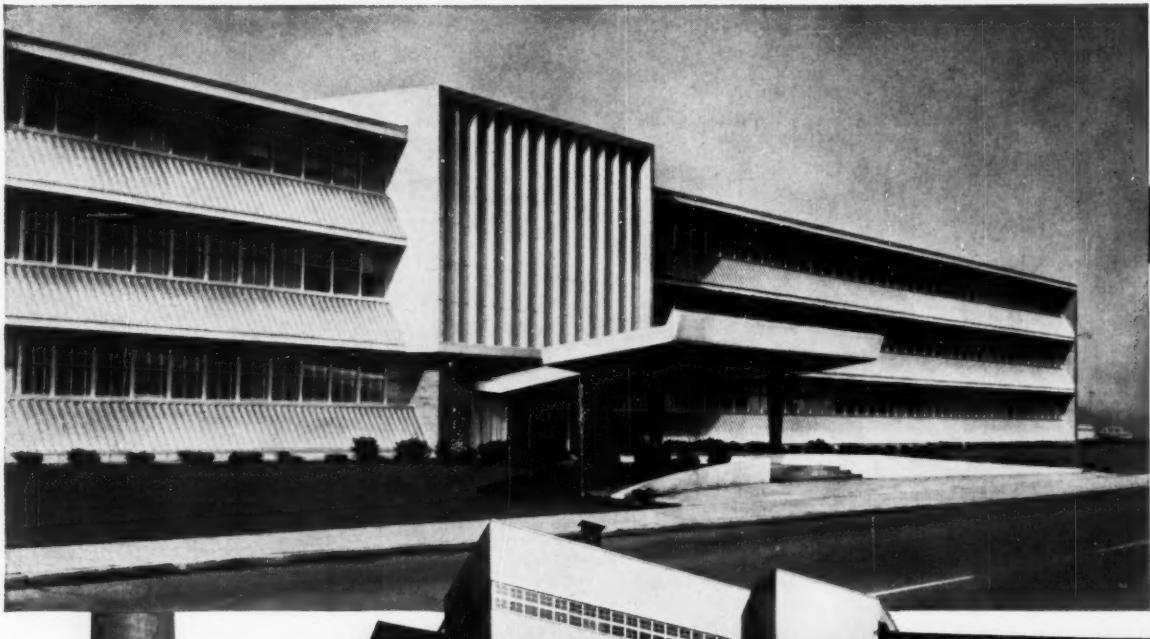
A DIVISION OF DRESSER INDUSTRIES, INC.

458 Wilson Avenue,

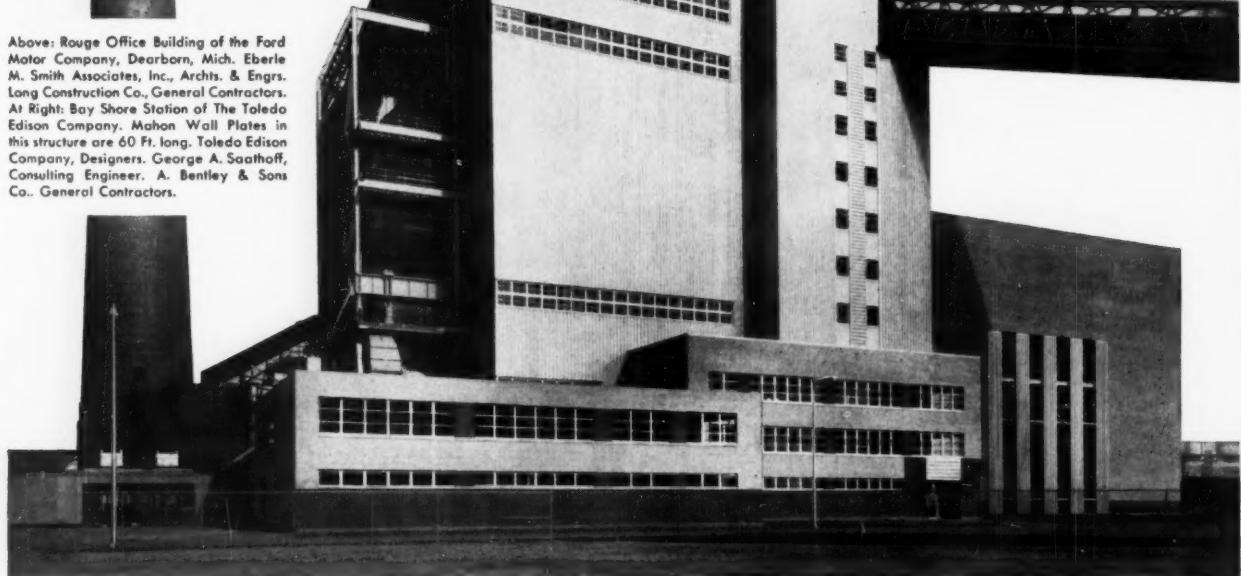
Connersville, Indiana. In Canada - 629 Adelaide St., W., Toronto, Ont.



Mahon METAL CURTAIN WALLS



Above: Rouge Office Building of the Ford Motor Company, Dearborn, Mich. Eberle M. Smith Associates, Inc., Archts. & Engrs. Long Construction Co., General Contractors.
At Right: Bay Shore Station of The Toledo Edison Company. Mahon Wall Plates in this structure are 60 Ft. long. Toledo Edison Company, Designers: George A. Saathoff, Consulting Engineer. A. Bentley & Sons Co., General Contractors.

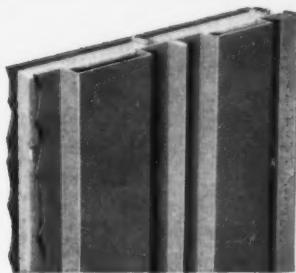


Serving the Construction Industry Through Fabrication of Structural Steel, Steel Plate Components, and Building Products

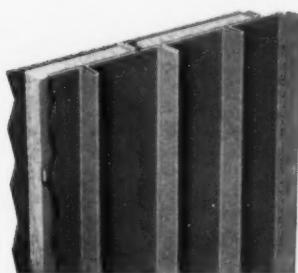
can be Erected up to 60 Ft. in Height Without Unsightly Horizontal Joints!

Vertical Joints are Invisible... Symmetry of Pattern
is Continuous Across the Wall Surface

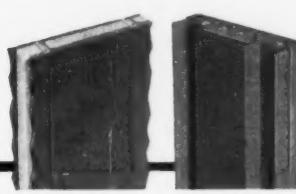
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M A H O N



Report From The East Coast

STAFF

DEAN ELMER C. EASTON, of the College of Engineering, Rutgers University, thinks the proper utilization of engineering manpower is more important now than ever before.

"I would not term it a problem of utilization. It is more a problem of national survival."

Dean Easton, who will be host within a few days to the New Jersey Conference on the Utilization of Scientists and Engineers, explained that proper use in a question of quality rather than quantity.

His solution to the United States' need for a satellite would not have been to assign hordes of engineers to the project. "They would have been better off with one man who knew what he was doing," Dean Easton added. "You do not develop quality by pooling ignorance."

Need Graduate Work

Where are the talented and creative engineers of the future going to come from?

The Dean does not think that the encouragement of masses of youths to go into engineering will solve this problem. "More graduate work is the answer."

Dean Easton told of recent testimony before the Senate committee on labor and public welfare. This testimony showed that of engineering students who receive a bachelor's degree, only 16 percent go on to receive a master's degree. And of those with master's degree, only 5 percent receive a doctorate.

"We are pushing everyone too hard to make them get a college degree — cajoling, bribing, and browbeating. Instead of educating the masses, we should concentrate on educating the talented. Our survival will depend on a few well educated people."

Dean Easton said his theories of selective education are not considered democratic by some. "But

our present policy of forcing everyone to have a college education is not democracy. It is regimentation. True democracy would give everyone the opportunity to be educated to the limit of his capabilities. It would not force him beyond these capabilities merely to fit him to a pattern."

How are educators to recognize this talented minority?

At present, a group of colleges, including Rutgers, is working with what will be at least a five-year program. A battery of tests is being given to senior engineering students. These boys will be observed closely after they begin working, and an effort will be made to correlate their grades and attitudes in college with their later accomplishments.

Become Technicians, Not Engineers

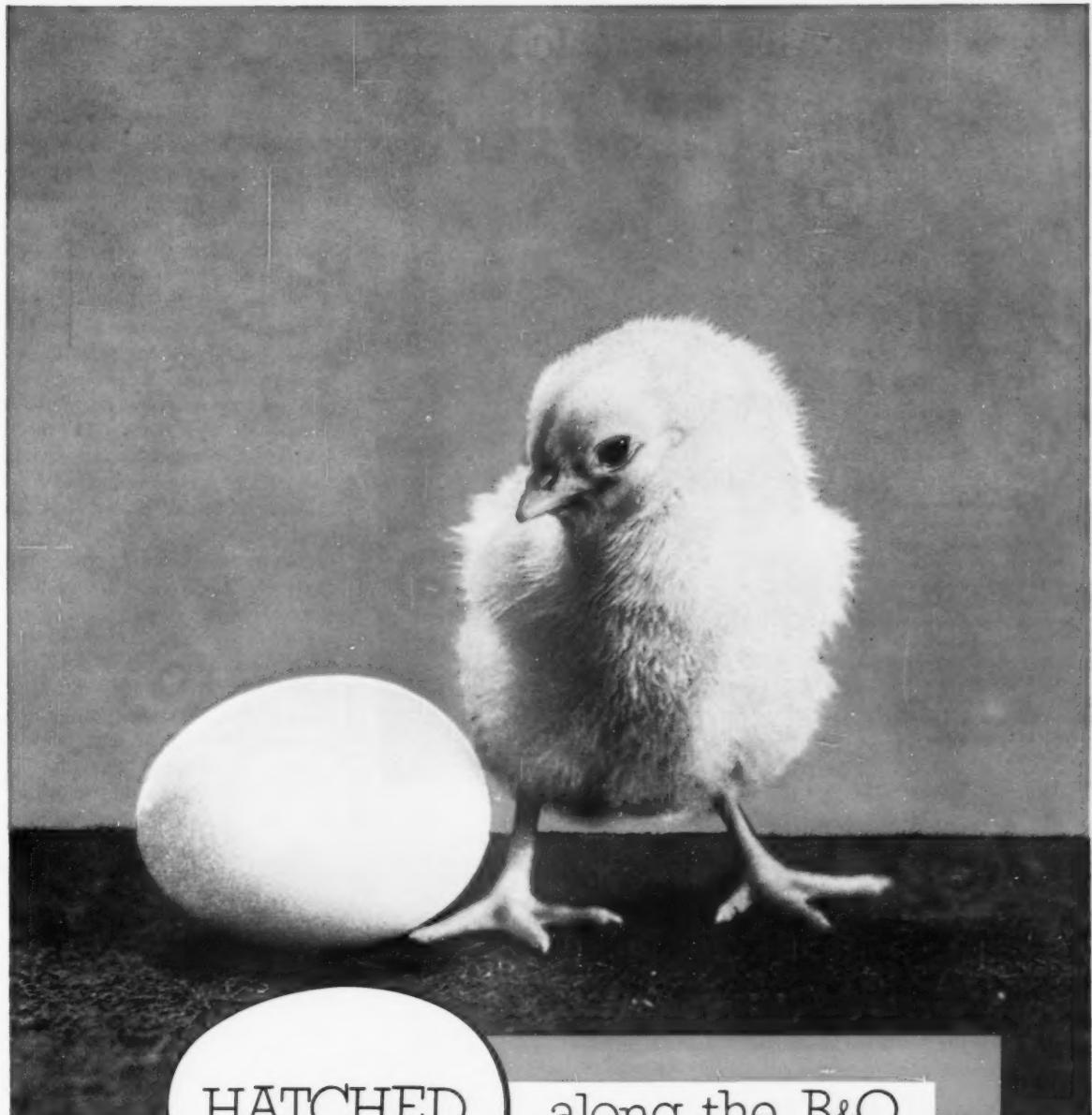
Dean Easton said that many boys who would make excellent technicians are pressured into continuing their education beyond their capabilities.

"We get misinformed hot-rod enthusiasts, who think they ought to be mechanical engineers. Or some boy who once fixed a television set thinks he should become an electrical engineer."

Dean Easton thinks if the pressures of society were lessened, many of these youths would be happy, competent technicians.

The Dean told of Penn State's complete counseling service, which is working very well. They test prospective engineering students thoroughly. Among the criteria for selecting future engineers is the assumption that a student should have an intelligence quotient of at least 120.

For the students who want to become engineers, but who do not meet the qualifications, Penn State has technical institutes located throughout the state, and it makes a serious effort to guide the less



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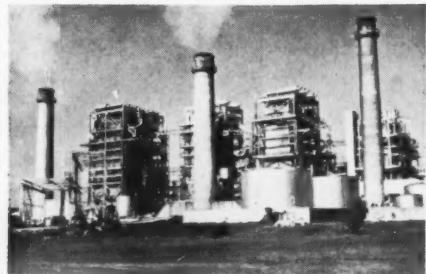
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BALTIMORE & OHIO RAILROAD

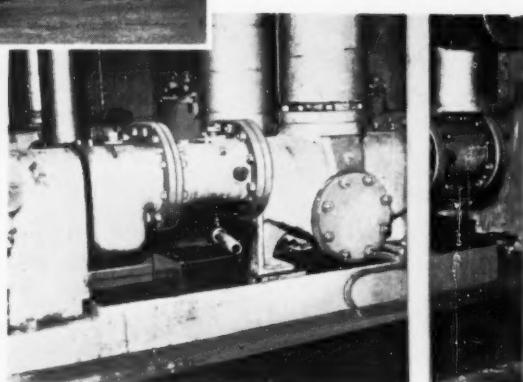
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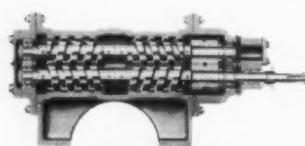
In 1955, the Cutler Plant in the Miami area, installed two Sier-Bath size NH Screw Pumps (external gear and bearing type) for transfer of fuel oil having a viscosity of 7,800 SSU. Each pump has a capacity of 420 gpm and discharge at 100 psig. These pumps have provided steady, trouble-free pumping since installation.



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qualified young men to these institutes. The results are reported to be satisfactory to all.

Dean Easton hopes the series of utilization conferences being held all over the nation will lead to a more extensive use of technicians for duties they are capable of handling, thereby freeing the engineers to do more creative work.

"In New Jersey, I hope this conference will help some to see our great need of training facilities for more technicians." At present, only two schools in New Jersey offer courses to technicians. "The need for technical institutes is growing, and it is growing rapidly."

Dean Easton estimated that the ideal would be to have three to five technicians working with every engineer. "Right now, the ratio is more like one to one."

For technicians, Dean Easton thinks unions are fine if the men want to join them. But he warned that regimentation of engineers by unions or management would kill creative thought. "If anyone ever succeeds in controlling the time and hours an engineer spends on the job, then the country is doomed. Regimentation kills engineering creativity."

Dean Easton told of one professor at Rutgers "who has more ideas than any ten other men I know. He goes home during the day sometimes, relaxes, and thinks. His wife worries about what some of the other people on the staff might think of his going home at all hours. My only concern is that he continue to produce those ideas."

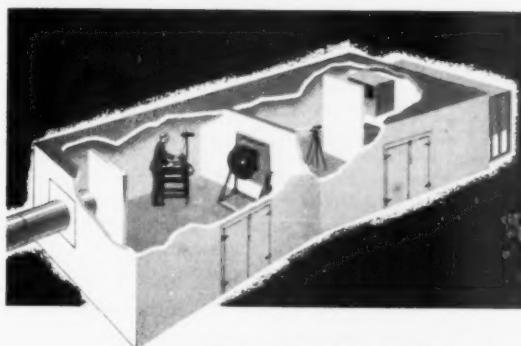
The informality of a small consultants' office, with the lack of hourly regulation and the absence of a time clock, is an excellent atmosphere for young genius. However, Dean Easton thinks too few of the graduates realize this. "The consulting engineer has not sold what he has to offer."

However, the Dean offered a word of advice about the informality of many smaller offices. "It can be carried too far." The young



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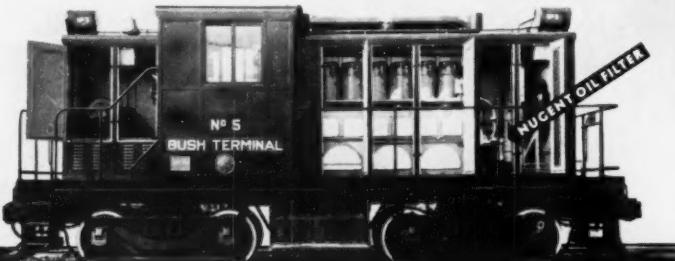
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December 13, 1957

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Yours very truly,

C. W. Jud
Master Mechanic

CWJ:ec

Mr. C.W. Jud, author of the statement above, is well qualified to judge the long term economy of Nugent *Full Flow* Filtering. Master mechanic for Bush Terminal Railroad Company, he was with that organization prior to 1932, when these seven Ingersoll-Rand diesel powered G.E. locomotives went into service. Mr. Jud reports that after more than 25 years of continuous service the majority of internal engine parts still require no replacement. This fact he attributes to the excellent performance of Nugent Lube Oil Filters, installed as original equipment on these engines.

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engineers should respect the men with whom they work. He suggested that this respect should begin with the young graduates being required to call their project engineers "Mister." "They should be on a first name basis only with persons on their own work level."

In Russia, the respect and honor paid to the engineer is a great incentive to the young people to try to be engineers themselves. "Young Russians want to become engineers because of the profession's prestige, not because they are ordered to study engineering, as so many Westerners seem to think."

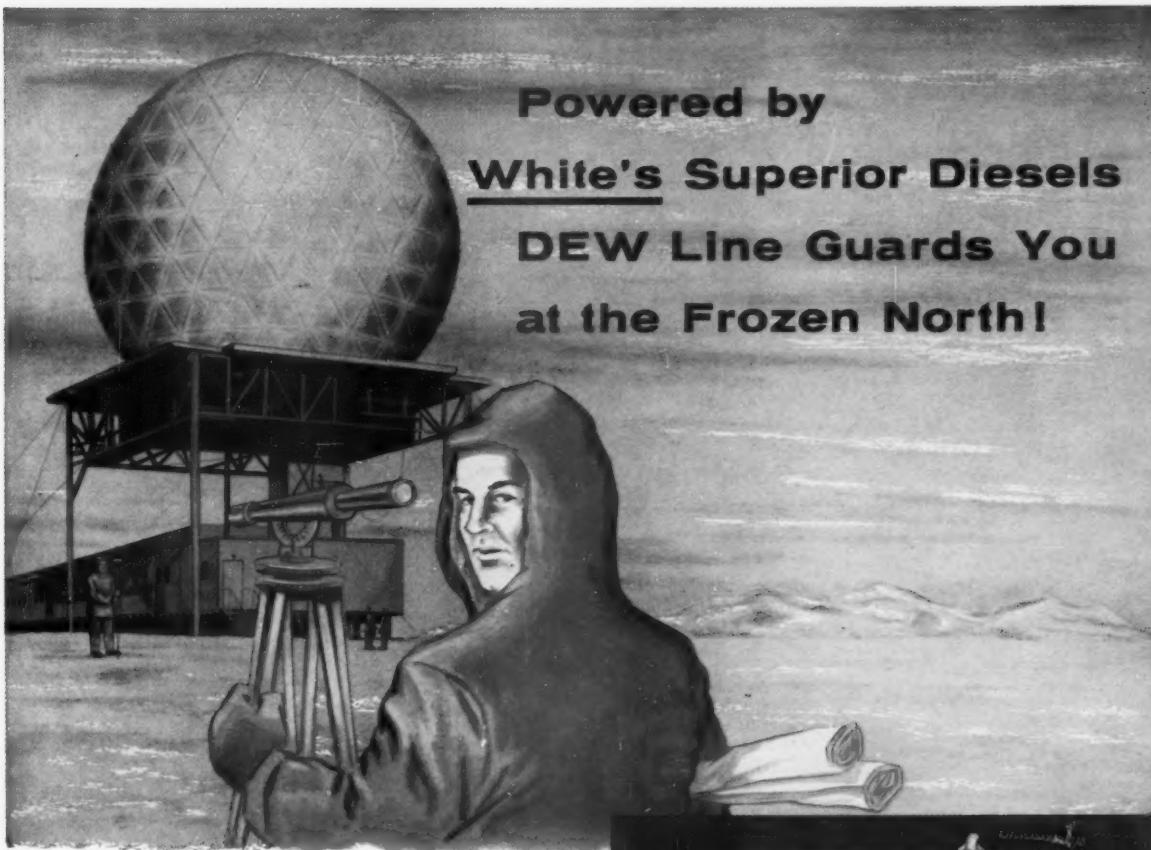
And while the Russians are placing a top value on their engineering talent, in the United States many young engineers are assigned to do the work of technicians.

Many employers, including consulting engineers, feel they cannot get technical work done as well by a technician as by an engineer, so engineers are forced to do subprofessional work. This is a luxury our society cannot afford."

The complexity of our civilization is changing the trends of engineering education, and placing an added responsibility on the employer. Colleges are turning more and more to theory.

"It seems that the more problems we solve, the more new problems develop. Therefore, we cannot just teach the solutions to problems of the past. We must equip the students to understand the broader and more basic theories. We can give them the best theoretical background possible, but only employers can provide the training to implement these boys into the business world."

Dean Easton pointed out that the Engineers Council for Professional Development has advocated a professional training program for the first five years an engineering graduate is working. The aim of this program is to orient the youth to professional practice, providing the engineering equivalent to the medical internship. ▲▲



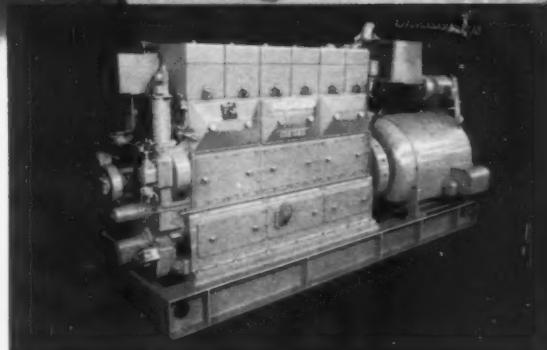
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Ebasco
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"twin"
Rayonier mill

...Jeffrey equipment installed in 1954



Jeffrey belt conveyors transport wood chips to storage towers . . . move material to giant digesters as needed for production of chemical cellulose at Rayonier's Jesup plant.

CONVEYING • PROCESSING

duplicated in new chemical cellulose plant

When progressive companies plan new production facilities, they get outside help on many or all important phases of that planning. Consulting organizations like Ebasco are most useful when they have a high level of experience in *your industry*... and broad engineering, construction and equipment knowledge gained through close contact with *many industries*. Such two-way specialization is extremely important in planning and constructing new plants... and in selecting equipment which will provide the most efficient, profitable production operations.

Rayonier's new plant at Jesup, Georgia, is a twin to the plant completed there in 1954. Each has capacity to produce over 300 tons of chemical cellulose per day. These remarkably low-cost production facilities were designed and constructed by Ebasco Services Incorporated. This company's extensive knowledge of applicable equipment made important contributions to the achievement of efficient, continuous-flow production.

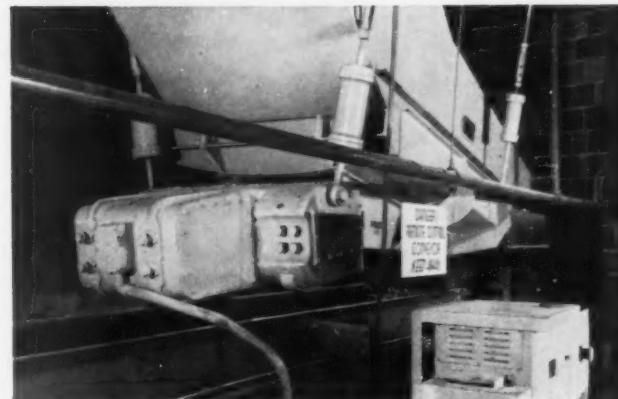
Three-year-later duplication of the original Jesup mill indicates the high degree of satisfaction experienced with the original equipment. Jeffrey vibrating feeders, belt conveyors, bark and grit removal equipment were selected in 1954...and again in 1957!

PLANNING TO EXPAND YOUR PRODUCTION?

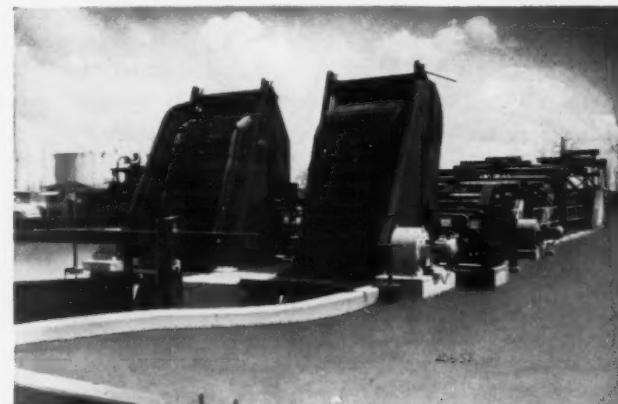
It will pay to team up with consultants who have extensive experience in *your industry*... and equipment manufacturers who are known for advanced product design and long-lasting product quality.



In-plant conveyors like this, or belts extending miles across the country, run on Jeffrey conveyor belt idlers.



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Jeffrey bark and grit removal equipment for clarification of processed water.

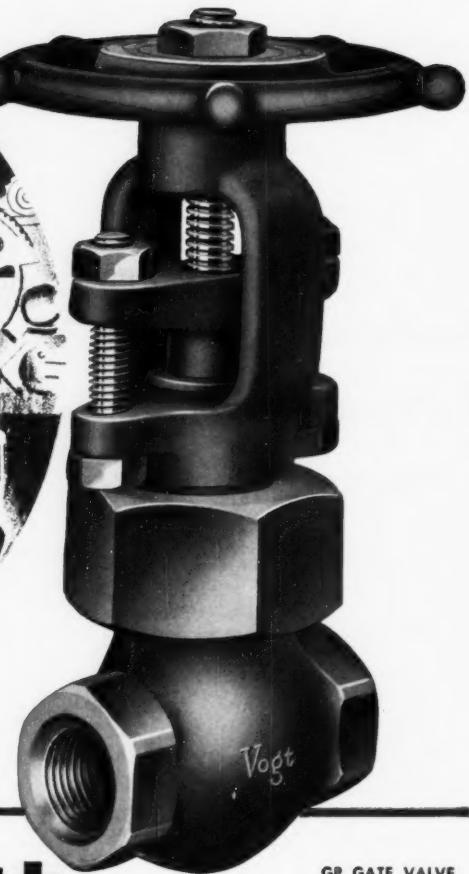
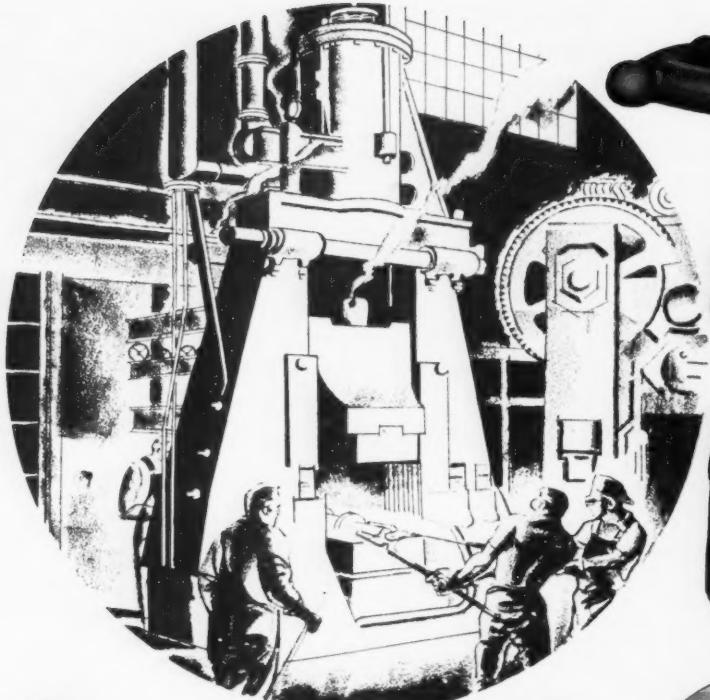
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New U. S. Embassy in Morocco

Plans for America's new embassy office building and ambassador's residence in the recently established sovereign state of Morocco have been approved by the U. S. State Department. Construction bids are being secured from local contractors.

Located in the capital city of Rabat, the embassy was designed by the New York architectural firm of Ketchum, Gina & Sharp. Structural engineers on the project are Severud-Elstad-Kruger, Associates; mechanical engineer is Guy B. Panero.

The project will consist of an office building for the embassy and the consulate, and a residence which will serve both as a private home for the ambassador and as a center for formal public receptions. Both buildings will fit on a four-acre site in a residential area near the King's palace. Because of the site's elevation, employees and guests will enjoy a panorama of the entire city and a view of the Atlantic Ocean.

Wherever possible, local building materials and construction methods have been specified. This, for example, influenced the choice of reinforced concrete for the structure and local stone for the masonry walls. It also led to the selection of wood grilles set with brightly colored glass inserts for the second level office walls overlooking the patio and the upper floor of the ambassador's residence.

Since Rabat's climate is similar to that of southern California, full air conditioning will not be required. Instead, adjustable transoms will catch the prevailing Atlantic breezes to permit air circulation.

Thames River Barrier

Detailed plans and estimates for an anti-flood barrier across the Thames River below London have

Beyond Our Borders

been drawn up on the instruction of the British Ministry of Housing and Local Government. This proposal is the result of years of research and experiment, and provides for the building of giant sluicegates about 20 miles below London Bridge.

These sluicegates would allow unrestricted navigation of the river except during flood periods, and are expected to prevent recurrence of the disastrous floods of 1928 and 1953.

The project is a direct result of the inquiry by the late Viscount Waverley's committee into the 1953 floods. Experiments were made on the committee's behalf at the Hydraulics Research Station, Wallingford, Berks., using models of the lower Thames. These were so encouraging that two firms of consulting engineers, Rendel, Palmer and Tritton, and Sir Bruce White, Wolfe, Barry and Partners, were appointed to collaborate in planning the



AN ARCHITECTURAL RENDERING OF ENTRANCE TO THE NEW AMERICAN EMBASSY IN RABAT, MOROCCO.

barrier, estimating its cost, and drawing up the necessary details.

Further tests on practical aspects of the scheme were begun at Wallingford last summer. Some calculations remain to be made, but it is believed that the final report will show the barrier to be both feasible and effective for flood prevention.

Ebasco Studies Australian Railway System

In a study recently completed for the Government of New South Wales, Australia, Ebasco Services Inc., New York engineering, construction, and business consulting firm, has recommended a five-year, \$150-million rehabilitation and modernization program for that country's railway system.

The result of ten months of work by a six-man team from Ebasco Services, the program provides for additional railway electrification costing about \$13.5 million and dieselization costing

about \$34 million. Use of centralized traffic control, self-propelled passenger cars, increased automation of freight classification yards, and greatly expanded mechanization of track maintenance, accounting and stores procedures were also recommended.

The New South Wales railway system is roughly comparable in size to the Atlantic Coast Line or the Chicago & Northwestern Railway in the United States. The local transit system serving Sydney and Newcastle carries annually more than twice the number of passengers carried by the transit system in Washington, D. C.

Weir Completes Mine Report

Paul Weir Co., Inc., a Chicago consulting engineering firm, has fulfilled a commission to prepare examination reports on two coal mines in Australia for a potential bidder. The mines, near Sydney, in New South Wales, were inspected personally and a report

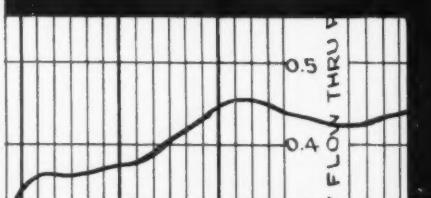
rendered by Paul Weir, chairman of the board, and his son, John, a vice president. Among its worldwide activities, the Weir company is engaged in major projects in Turkey, Korea, and Brazil.

Canadian Photogrammetry

New advances in photogrammetric techniques, stemming in part from the development of electronic computers, have been developed and are now being put to use by scientists of the Photogrammetric Research Section of the National Research Council of Canada's Division of Applied Physics, Ottawa. Although Great Britain, France, and the United States are also active in this field, the computational formulas obtained by the Canadians seem to be the simplest proposed thus far; experimental mapping, with distances up to 200 miles processed by analytical methods, has proved highly satisfactory.

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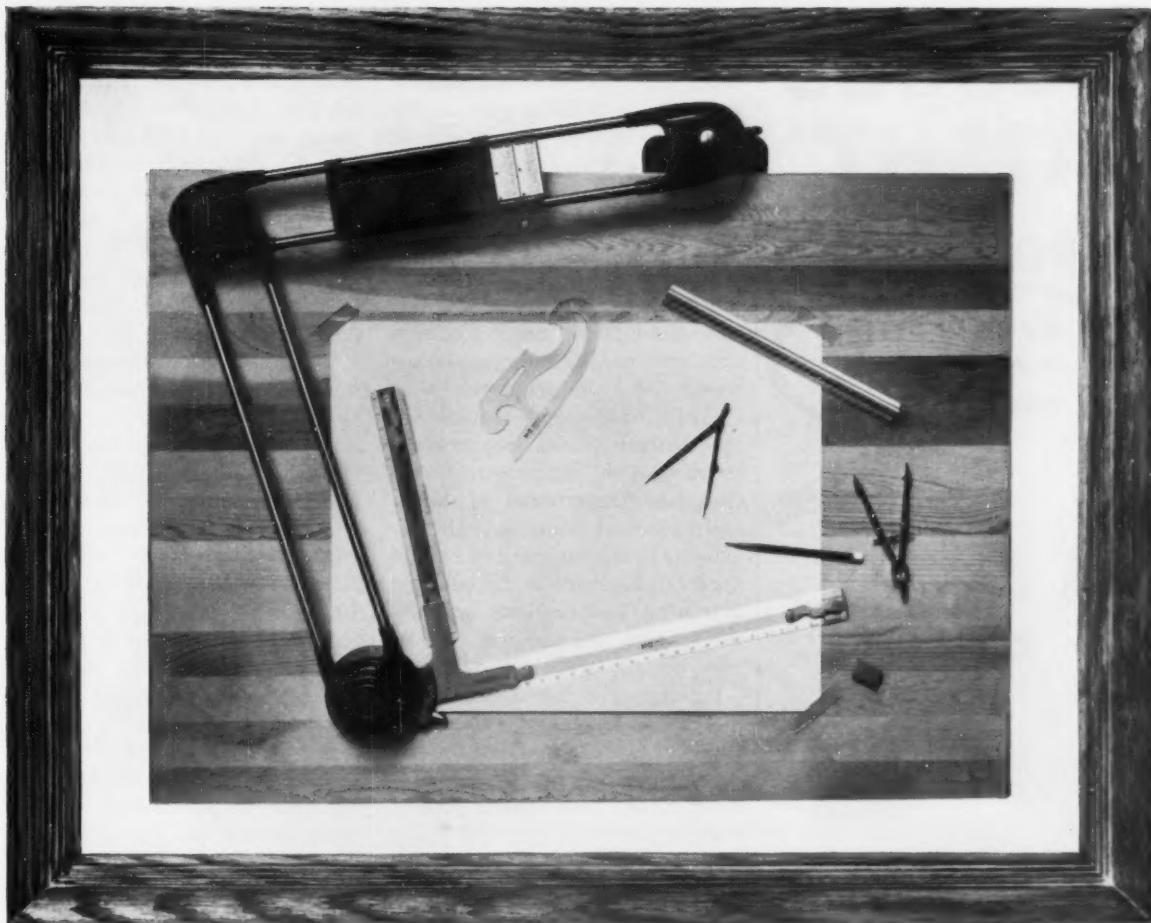
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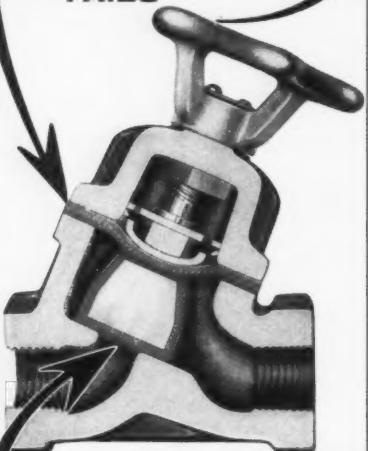
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method, according to T. J. Blachut, head of photogrammetric research at N.R.C., permits the surveying of very long distances exclusively from the air, thus obviating the complicated network of ground control points previously required for this work. Simple and accurate bridging of distances up to 200 miles is now possible through the use of auxiliary data obtained by oblique photography and radar altimeter.

While both Great Britain and the United States are experimenting with this method, the Canadian Department of Mines and Technical Surveys is already using it in the mapping of remote northern regions. It is believed that with modifications and improvements the method can be used equally well in topographical mapping of developed areas.

Another outstanding Canadian "first" is a new instrument which uses electronic computations, rather than optical projections, in plotting maps from aerial photographs. Developed by U. V. Helava, it is smaller than previous models and involves fewer mechanical components. It also permits correction by electronic computation of all known errors in the mapping process and even indicates the eventual automation of mapping procedures.

The new plotter, containing a specially designed computer developed by W.J.M. Moore of NRC's Radio and Electrical Engineering Division, is now being built. The plotter is expected to result in more accurate and more economical mapping, and is regarded as an important contribution to photogrammetry science.

Highways in the Belgian Congo

As part of its continuing ten-year development plan, a \$70 million road construction and improvement program has been initiated in the Belgian Congo to serve important agricultural, mining, and mercantile areas.

Costs of imported equipment, materials, and services required for work on the highway system between now and 1960 will be covered by a \$40 million loan from the World Bank. The project involves construction of 750 miles of new highways, improvement of 560 miles of existing roads, and preparation for mechanized maintenance of a further 2060 miles.

One of the new highways will provide an all-weather link between Leopoldville, the capital, and the Atlantic Ocean port of Matadi, passing through an important agricultural region. Another will connect important mining centers in the Province of Katanga, which contains one of the world's largest deposits of copper, and a third will provide access to East African railways in Uganda for shipment of exports through the Indian Ocean port of Mombasa. Improvement of the road from the northeastern highlands to Stanleyville on the Congo River will facilitate marketing of coffee and rubber for export and foodstuffs for local consumption.

The present transport system, which is based upon navigation on the Congo River and its tributaries, is geared mainly to the export trade. Railroads serve to bypass cataracts on the rivers, to penetrate from river ports into regions producing the main export commodities, and to establish international connections leading to ocean ports in other parts of Africa. Most of the roads radiate from the cities for relatively short distances and provide farm-to-market connections rather than long-distance links.

There are only 310 miles of paved-surface roads in the whole country, some of which are impassable in the rainy season. Road traffic has increased rapidly in recent years and the number of cars and trucks has risen about fourfold since 1945. As the internal market grows and the econ-

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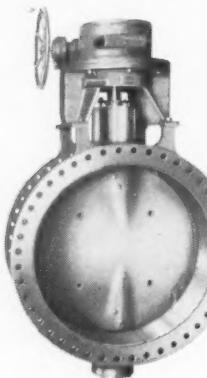
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omy becomes further diversified, road traffic is expected to more than double in the next decade.

Australia's New Dam

Australia's big and ambitious Snowy Mountains hydroelectric project in New South Wales has been expanded to include the building of a 150-ft high concrete storage dam at Tantangara on the Murrumbidgee River and the construction of a 10-mile, 11-ft diameter tunnel between the latter and the Eucumbene Rivers. Work on the dam and tunnel will get under way during 1958, with completion of the dam scheduled for 1959 and that of the tunnel during 1960.

Ivory Coast Gets New Bridge

Recent economic growth on the Ivory Coast has brought with it a sizeable increase in vehicular traffic, and the enforced obsolescence of the floating bridge. The new structure which connects the northernmost point of the Petit-Bassam island with the urban district of the Plateau was begun in April 1954 and is now nearing completion. Designed to carry a daily traffic of 30,000 vehicles, the 1788-ft bridge is 98 feet wide and was built according to the latest bridge building techniques.

The muddy depths of the lagoon presented extreme difficulties in digging the foundations, often as deep as 230 feet. The problem was solved by placing the spans on six piles and two column-wells hollowed out in the slime. The main part of the bridge is composed of spans formed by two tubular beams. The 800-ton tubes of prestressed concrete were made on the construction site, and were fixed in place by sliding them over the cast concrete pillars to a solid foundation on the sand underneath. The upper roadway of the bridge is 46 feet wide, and accommodates four-lane traffic. A bicycle path on one side and a pedestrian

walkway on the other, each 13 feet wide, are separated from the traffic lanes by safety borders. Rail beds pass under the upper roadway and inside the tubular beams, connecting with viaducts at each end of the bridge.

Japan's First Superhighway

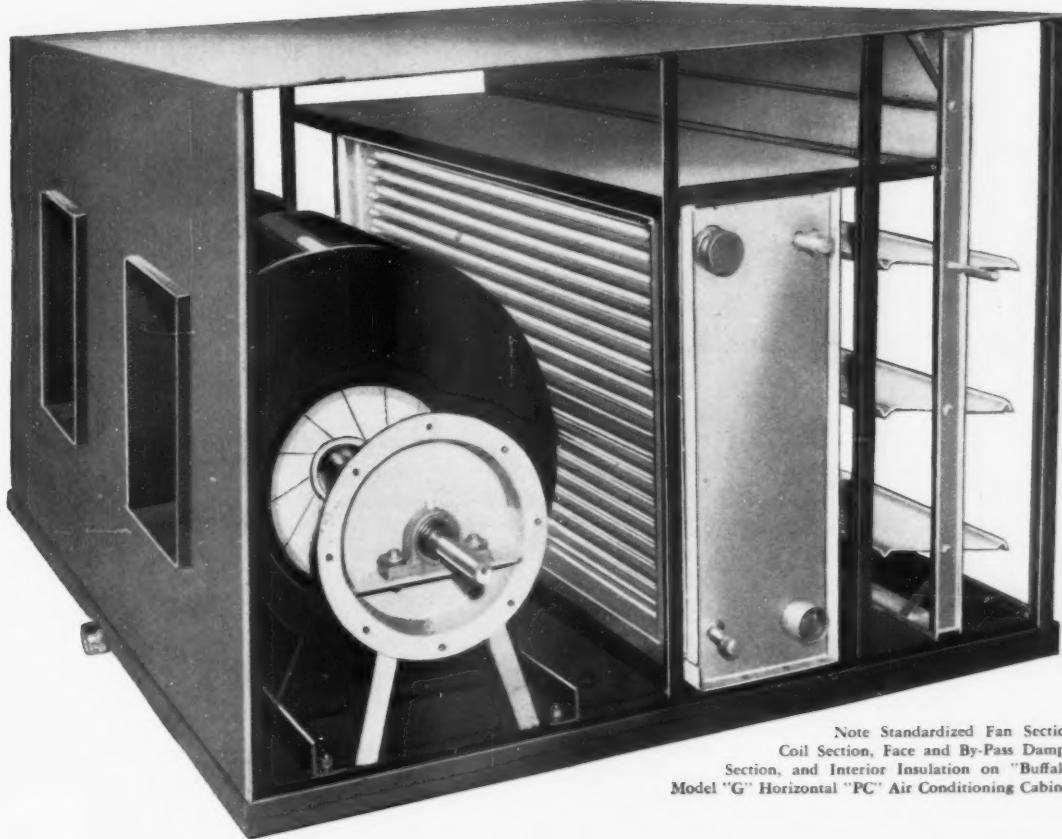
The Japanese Construction Ministry is initiating action to build Japan's first 4-lane superhighway, scheduled to connect Nagoya and Kobe by 1960. Highway planners estimate a total construction cost equivalent to \$220.3 million for a 115.5-mile road permitting driving speeds up to 75 miles per hour.

Financing for the project is being sought from three sources—a \$78-million World Bank loan, to be converted into local currency; central Government appropriations; and a public bond issue.

Part of this program includes sending of four highway teams to the United States to study specific technical aspects of American highways having a direct bearing on superhighway construction in Japan. Technical aspects include use of mechanized construction equipment; work procedures for highway construction including surveys, highway design and cost estimation, contracts with construction firms, supervision of construction, and inspection; urban highway traffic routing, including overpasses, access roads, and parking areas; management of expressway operations, including traffic-control procedures and service facilities; and design, construction, and maintenance of highways, bridges, and tunnels.

British Consultants Meet

The Association of Consulting Engineers held its annual dinner at the Dorchester Hotel, London, on February 17. Prominent guests included the British Minister of Power, the Chairman of the British Transport Commission, the High Commissioners in



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London of Australia and Rhodesia, and the President of the Federation of British Industries. Also present as guests of the 450-member Association were heads of professional institutions, government officials, and representatives of trade associations.

Two points of concern to members of the Association were dealt with in the address by Lord Mills, British Minister of Power. He stated that the Government's decision to hold the level of investment area at the 1957 level means that there would be a temporary halt in expansion by government and private industries. The British Minister of Power reminded his audience, however, that the current level of investment was high, and it was the Government's wish to increase expenditures soon.

Lord Mills then discussed the decreasing proportion of work carried out by the consulting engineers for the electricity authority in Great Britain. "Before the war, there were over 560 separate electricity authorities. Now, in effect, there is only one. Before the war, electricity was supplied by a large number of small power stations. Today, and increasingly in the future, it will be supplied by a small number of very large power stations."

The nuclear power station is a particularly sore point with English consulting engineers. The program is under the control of the nationalized electricity authorities. Design of the four nuclear power stations currently under construction in England and Scotland has been awarded to four groups of industrial firms. No independent consulting engineers were employed directly, although some were called in by the contractors, mainly for civil engineering work. English consultants feel there is a big export potential for nuclear power stations—British-type stations are to be supplied to Japan and Italy

—so they would like to gain experience, until now denied them, on the British nuclear power program.

The chairman of the Association of Consulting Engineers, Bryan Donkin, gave an account of the organization's progress and talked of the British consultant working overseas. He pointed out that some consider the British consulting engineer is at a disadvantage in obtaining work overseas by reason of their rules of professional conduct. He then declared, "It may be that some relaxations are necessary for work in foreign countries, but I am far from convinced that any wholesale relaxation of professional conduct would be to the advantage of the profession. Those of you who are working abroad, especially in difficult places like the Middle East and in newly independent territories like Ghana, and in South America, will have found that the professional integrity and independence of the British consultant is appreciated."

Mr. Donkin said that the International Conditions and Contract for civil engineering works has been completed and approved by FIDIC, the International Federation of Consulting Engineers. Steps were already taken, he stated, to prepare similar international conditions for electrical and mechanical works.

The Right Honorable J. K. Vaughan-Morgan, Member of Parliament, Minister of State at the Board of Trade, paid tribute to the contributions made by British consulting engineers to the country's exports. Overseas construction projects in which British consultants participated amounted to \$260 million, an increase of \$20 million over the previous year.

Argentine Tidewater Power Study

The Federal Energy Administration (Direccion Nacional de la Energia), Buenos Aires, Argen-



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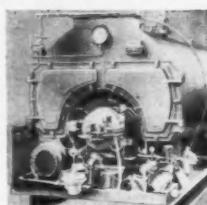
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tina, has signed a \$100,000 contract with Societe Grenobloise d'Etudes et d'Applications Hydrauliques of Grenoble, France, to determine the practicability of constructing a tidewater power station in the southern Argentine province of Chubut.

Specifically, the French firm is to determine the economic and scientific soundness of digging a 3½-mile channel across the Valdes Peninsula and harness Atlantic Ocean tides for a power station of 600,000 kw. This would be equal in potential to the thermoelectric plant to be completed at South Dock, near Buenos Aires, in about four years, and would be double the potential of the recently inaugurated San Nicolas thermoelectric plant.

The Valdes Peninsula appears to be particularly promising as a site for the power project because of its unique tidal conditions. The tide is at high water on one side of the narrow peninsula at the same time it is at low water on the opposite side.

Italy Plans Highway Network

Italy has begun work on a grandiose plan for a network of modern highways. This "Romita Plan," named after a former Minister of Public Works, foresees expenditure of more than \$750 million over 15 years.

Its first aim is to provide a fast, safe north-south through highway, connecting the principal cities of Italy, from the Alps to Sicily. A secondary aim is to build or modernize a system of subsidiary highways radiating east and west from the major artery, and designed principally for the rapid distribution of heavy goods to provincial centers.

The backbone of the system, dubbed the "Highway of the Sun," will connect, in the most direct line possible, Milan, Bologna, Florence, Rome, and Naples. Estimated to cost \$300 million, this master highway is to be fin-

ished by 1963. Work already is well advanced on the northernmost sector.

It will have twin two-lane roadways with an over-all width, including verges, of nearly 75 feet. It will extend 465 miles, over terrain that is often mountainous, at an average building cost of \$680,000 per mile. Gradients will not exceed 1 in 27.

The theoretical maximum safe speed for a vehicle traveling over the various sections will range from a consistent 100 mph between Milan-Bologna and Capua-Naples to a low of 62 mph between Bologna and Florence, where the Appennine passes are traversed.

Building of the Highway of the Sun alone will involve the construction of 304 major and 3800 smaller bridges, including one of three-quarters of a mile over the River Po, and the drilling of 81 tunnels with a total length of nine miles.

Although spread over a period of years, cost of the project will have to be met partly from foreign loans and aid programs.

Dissipator Developed in India

With the construction in India of major dams that compare in size with the highest in the world, the problem of disposal of excess water overflowing the dams, without causing injury to the bed below the weirs, has been assuming increasing importance.

Dam construction in India is not only for purposes of development of irrigation and power but also for the purpose of taming wild rivers which, in their natural state, have brought about havoc and desolation over vast areas, year after year.

Two south Indian engineers, R. K. V. Narasimham and G. R. Krishnamurthy, have developed a new type of dissipator that does not depend on the formation of a hydraulic jump.

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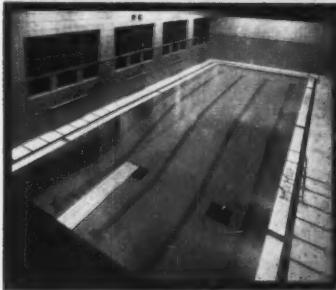


8025

NEW BOOSEY WATER LEVEL DECK DRAIN

Saves cost of

GUTTERS, LADDERS, STEPS



The new Boosey water level deck drain provides a new type of swimming pool design. Pool is filled to deck level and water level is controlled by weir plates set in the pool side face of skimmer trenches. Swimmers and non-swimmers roll onto the deck without the need for ladders.

Additional savings over old style pool designs include less tile to be set, simpler forms for concrete, 8 to 10% savings in depth of concrete and less operating, heating and filtering costs because all water is reusable. The result is a modern, safer pool at about the same cost as old style pools.

For more information about Boosey swimming pool products write for catalog number B-56-VA.

SW-581

NORMAN BOOSEY MFG. CO.
General Sales Office
5281 Avery Ave., Detroit 8, Mich.

BOOSEY

the foot of the spillway, into each of which a splitter is introduced. The splitter divides that portion of the falling sheet of water coming into each bay into two equal jets and guides them through channels for headlong impact at the lowest part of the bays.

These two Indian engineers, of the Hyderabad Engineering Research Laboratory, after making pilot experiments, tried this Interacting Jet Dissipator on a model of the spillway for the Koilsager Project near Hyderabad which has a high spillway. Later, this type of dissipator was recommended for the Bendsura spillway, now in Bombay State, and the Kaddam spillway in Hyderabad State, their heights being 55 and 81 feet and their heads of overflow being 6 and 20 feet, respectively. Results have been satisfactory and encouraging.

While the new dissipator is useful for spillways up to 120-ft high, further studies to determine whether it would be useful for larger heights are being carried on. Manometric pressure studies have not disclosed high cavitation pressures or negative pressures when it is used.

Pakistan Railway Improvement

The World Bank had made a loan, in various currencies, equivalent to \$31 million to meet part of the foreign exchange cost of a program of replacement, improvement, and expansion on the two railway systems of Pakistan.

Railways are vital to the economic life of Pakistan. In many areas they are the most economical carrier and in some the only carrier. Implementation of a number of major projects in Pakistan's Five-Year Development Plan, which covers the period 1955-1960, will increase agricultural and industrial production and create new demands on the railways. Moreover, large arrears in maintenance, dating from World War II and the early post-

war years, have not yet been made up fully.

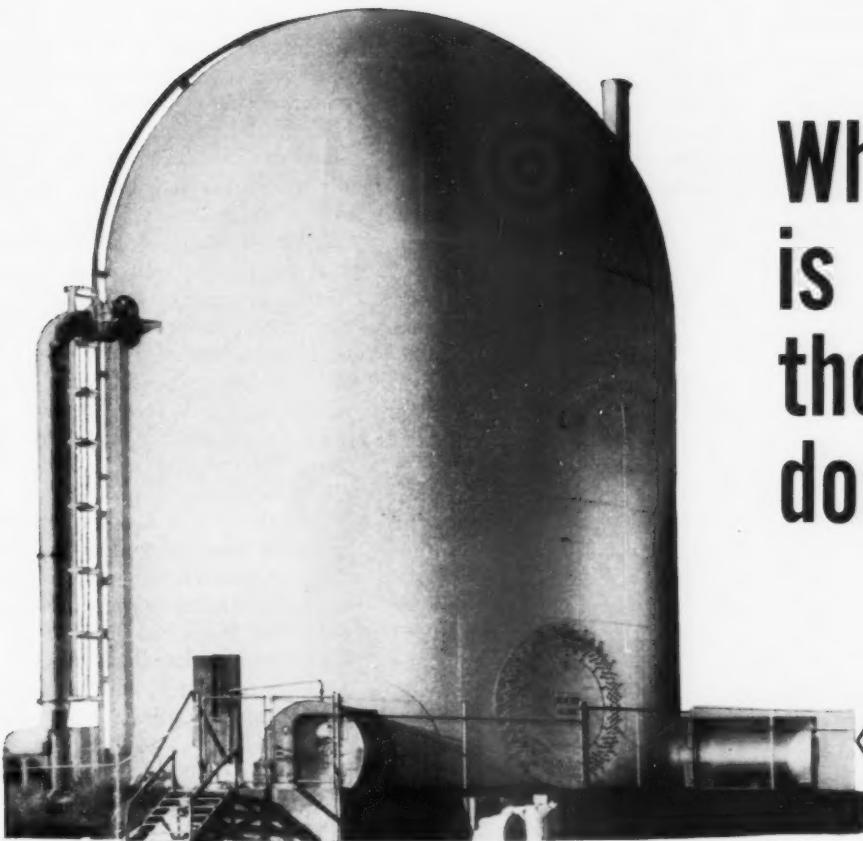
The two railway systems are entirely separate from each other. In West Pakistan, the North Western Railway, with 5340 miles of track, carries most of the freight traffic and about half the commercial passenger traffic. Because of the great distances involved and the poor condition of the local roads, road freight transport is still at a comparatively early stage of development. Bulk cargo such as wheat, cotton, and cement depends heavily upon the railways.

In East Pakistan, the 1710-mile long Eastern Bengal Railway carries about one-third of the total traffic; most of the remainder is handled by the inland waterway system. In both East and West Pakistan the railways provide the only economic means of transport for a number of areas and for various types of traffic.

The railway network as a whole is operating at a profit. In recent years there have been a number of improvements in efficiency. Vehicle-miles per day have increased and the percentage of locomotives out of service for repairs has decreased. Helped by a continuing rehabilitation program started in 1951, the railways are still able to handle the traffic offered. But much of the equipment, particularly steam locomotives and freight cars, is worn out. On many sections speeds are low and, in the absence of new investment, increasing delays are expected.

The present railway program calls for a total expenditure estimated at \$176 million. Of this, the equivalent of \$119 million will be in foreign currency. In addition to the Bank's lending, Pakistan's own resources are being supplemented by foreign aid funds and a credit from the United Kingdom.

The first Bank loan, the equivalent of \$27.2 million lent in 1952, financed the introduction of die-



Where is the door?

These two tubular entrances are the Pratt Air Locks in the Vallecitos Boiling Water Reactor at the General Electric Vallecitos Atomic Laboratory at Pleasanton, California.

The Henry Pratt Personnel Air Lock

provides easy passage in and out of containment vessels in full compliance with the AEC code for reactor construction.

While the Air Locks are designed and built specifically for each atomic power plant, they all include some very desirable Pratt developments.

An interlocking feature that keeps one door shut while the other is open is typical of the many simple operating principles that add up to a high safety factor. Any arrangements of automatic and manual controls can be incorporated.

The locks can be built to withstand any practical pressure with compression or pneumatic door seals . . . size is no problem—locks are now being built that will accommodate trucks.

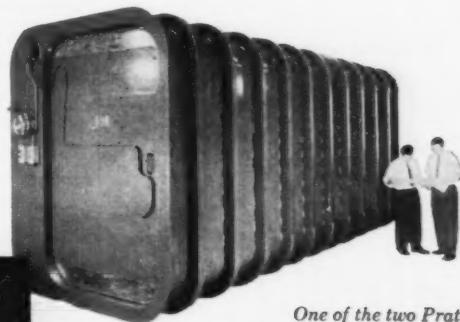
Air Locks already installed . . . Two locks in the Boiling Water Reactor of General Electric's Vallecitos Atomic Laboratory, Pleasanton, California . . . Two locks in the M.I.T. Research Reactor.

Air Locks now being built . . . Three locks for the C.N.R.N. Reactor, Ispra, Italy . . . One lock for the Enrico Fermi Atomic Power Plant of the Detroit Edison Co., Laguna Beach, Michigan . . . Two locks for the 30 MW Test Reactor at the General Electric Vallecitos Atomic Laboratory, Pleasanton, California.

Manufacturers of

Personnel Air Locks
Rubber Seat Butterfly Valves
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Specialized Steel Fabrication

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PRATT



One of the two Pratt Air Locks now in use at the M.I.T. Research Reactor.

Henry Pratt Company, 2222 S. Halsted St., Chicago 8, Ill. Representatives in principal cities

STEAM HEATING QUIZ

*Q: What type of steam heating system saves 20% on the fuel bill in the Oak Park, Mich. school system?**

A: SELECTOTHERM - Illinois Engineering's vacuum heating system.



* School designed and engineered by Odell, Hewlett and Luckenbach Associates, architects and engineers, Birmingham, Mich.

Mr. Entropy

If outdoor temperature is 32° it just doesn't make sense to generate and circulate steam at the same high temperature required when the outdoor temperature is 0° F. Selectotherm eliminates this waste by supplying steam at the proper temperature for use at any outdoor temperature condition.

Selectotherm features a single dial control for simplicity of operation. The heating system is "Tuned in With The Weather" by this single dial setting—no "gadgets" to operate or maintain.

Selectotherm can be applied to new construction or is ready to go to work in older buildings—regardless of fuel or mechanical firing device.

Get all the facts. Write for Selectotherm booklet, *Boiler Room Ballad*.



SELECTOTHERM
HEATING CONTROL SYSTEM

A product of Illinois Engineering Co.
Division of American Air Filter Co., Inc.
2035 South Racine Ave., Chicago 8, Illinois

sel locomotives on the main lines of both systems. These locomotives have made it possible to provide faster service and have resulted in substantial reductions in expenditure on imported fuel. Other equipment also is being paid for under the first loan.

About half of the new loan will be spent on freight cars. Most of the balance will be spent on cross-ties and rails. A small sum also will be used for the rebuilding of the Lansdowne bridge, which spans the Indus River about 250 miles upstream from the city of Karachi.

The Bank now has made seven loans in Pakistan totaling the equivalent of \$108,250,000. In addition to assistance for the railways, this lending has been for power and port improvements in Karachi; a natural gas pipeline from the Sui field to Karachi; reclamation of desert land between the Indus and the Jhelum Rivers; and a pulp and paper mill in East Pakistan. A loan of \$4.2 million to the Pakistan Industrial Credit and Investment Corporation was approved in September 1957. It will be signed in the near future following the establishment of the corporation.

Bridge to Span Lake Maracaibo

Plans have been completed by the Venezuelan Government to erect a bridge across Lake Maracaibo. The Ministry of Public Works has awarded a \$98-million contract for construction of the five-mile long bridge to a Caracas engineering firm, Precomprimido C. A. Plans call for completion of the project by mid-1960.

The city of Maracaibo is located at the head and on the western shore of Lake Maracaibo, and has no direct link with the rest of Venezuela lying east of the lake.

The bridge will cross a narrow neck of the lake, from Iguana Point, a few miles below Maracaibo, to Pedras Point. Construction will be of prestressed con-

crete with a minimum of steel reinforcement and for the most part will use Venezuelan-made materials. The designer of the bridge, Italian engineer Ricardo Morandi, also designed and built the Republic Viaduct on Severe Avenue, Caracas.

Over-all width of the bridge will be 72 feet, including 16 feet for a single railroad track in the middle, 41 feet for two double lane automobile roadways on each side of the railroad track, and sidewalks 2½-ft wide.

Specifications call for a central span 1312-ft long and 152 feet above the surface of the water, which will allow the passage of tankers and other large ships. Smaller vessels may go through a series of narrower spans ranging in width from 623 feet to 126 feet. Provision has been made for lighting, telephone, and telegraph wiring and for conduits to carry gas and water.

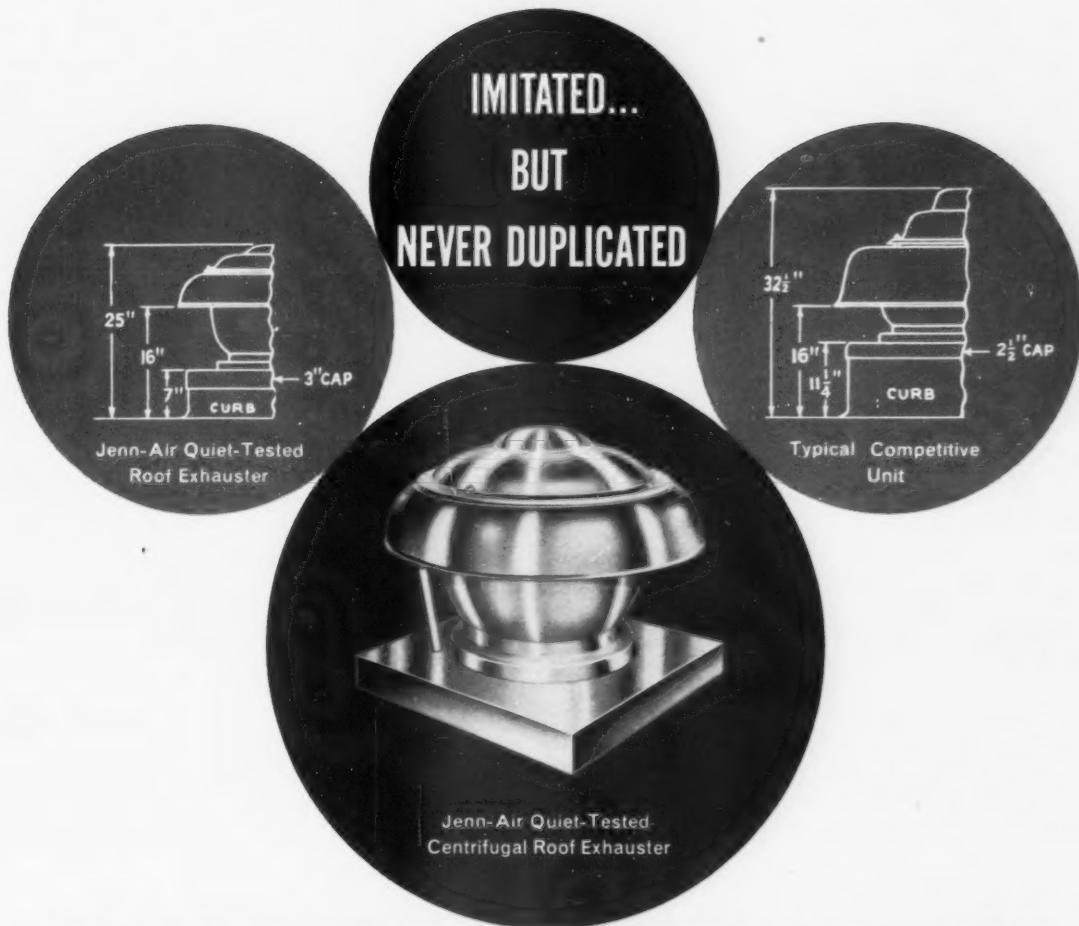
The four million bags of cement that will be required for the project will be of Venezuelan manufacture, although the 50,000 tons of steel for concrete reinforcements will have to be imported.

Ecuador Launches Highway Program

A \$34.5-million highway expansion program for Ecuador is under way, including the construction of new highways, improvement of existing roads, organization of a Road Department, and establishment of maintenance operations.

Rader and Associates, Miami, Florida, will furnish consulting engineering services.

Ecuador received a loan of \$14.5 million from the International Bank for Reconstruction and Development and will raise additional revenue necessary for this program through a gasoline tax and other assessments. The loan was made on the basis of a comprehensive economic feasibility report prepared for Ecuador by the Rader firm. ▲▲



ONLY JENN-AIR EXHAUSTERS OFFER TRUE LOW CONTOUR

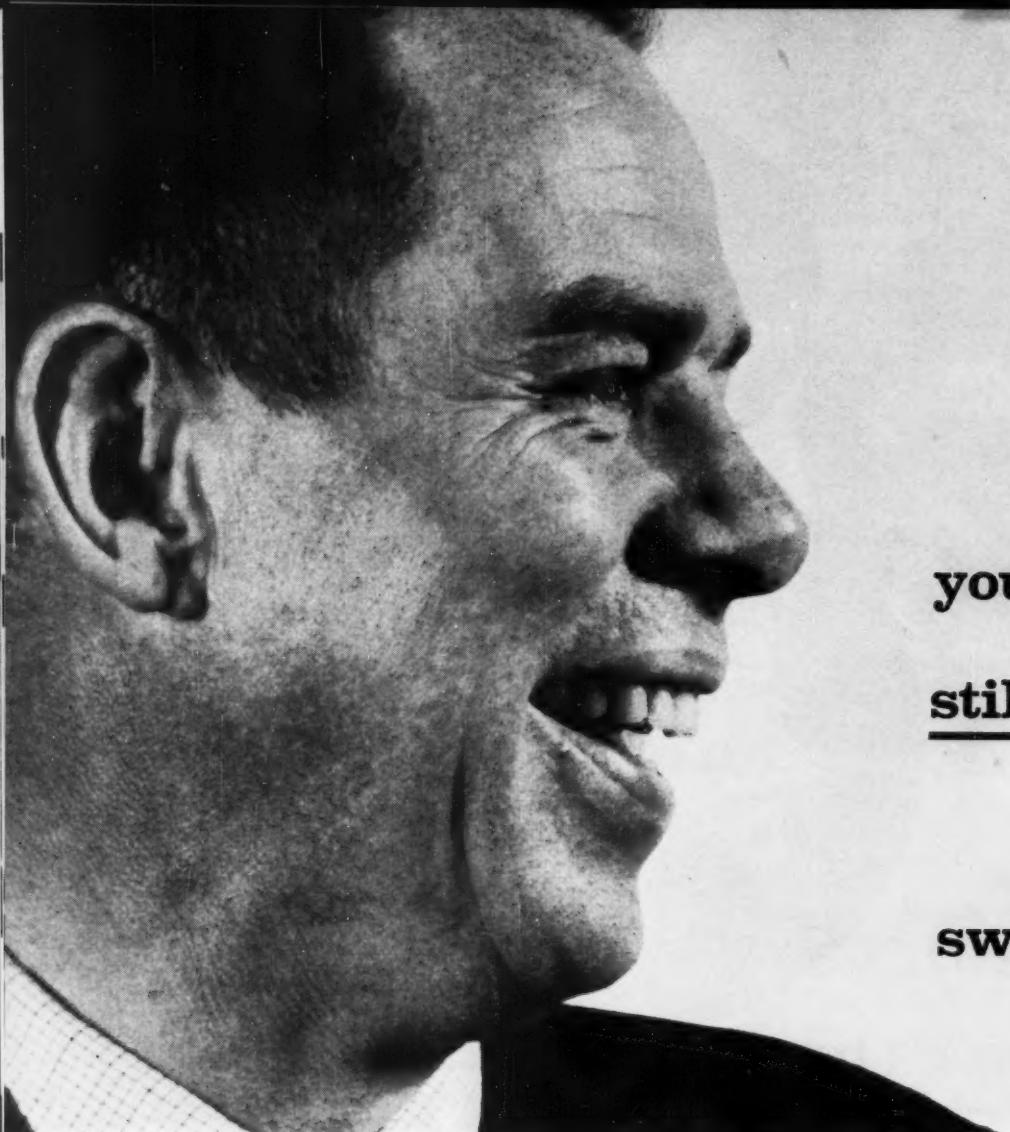
The Big Difference is in the Installed Height

To conform with modern construction, low contour in exhausters is the accepted design among architects, engineers and building owners. And Jenn-Air, first to develop low contour spun aluminum exhausters, still engineers the lowest contour of all. Only true measurement of exhaustor height is the distance from the roof level to the top of the exhaustor. Jenn-Air Quiet-Tested units, when installed, stand 25 to 50% lower than others—yet meet specifications for a discharge height at least 16" above roof level. This is achieved by Jenn-Air's exclusive method of nesting the motor below the discharge of the exhaustor. Thus, the base of the exhaustor itself supplies the additional height. In competitive models, with a discharge height of only 9 1/2", the curb base must be extended higher to attain the 16" position. Result: overall, installed height of competitive so-called "low contour" exhaustors runs 8" to 10" more than that of Jenn-Air. Have a Jenn-Air representative show you the "yard-stick test" . . . proof positive that only Jenn-Air Quiet-Tested exhaustors offer *true* low contour.



JENN-AIR PRODUCTS COMPANY, INC.

1102 Stadium Drive, Indianapolis 7, Indiana



**you're not
still using
safety
switches?**

**but if you are,
be sure to read these
facts from
Westinghouse . . .**



Safety switches versus AB-I breakers is an old, old controversy. Westinghouse manufactures both at their Beaver, Pennsylvania plant.

Here's their authoritative, unbiased report in the interest of better circuit protection:

Fact: AB-I's cost less. In most all motor applications, AB-I's are lower priced than an equivalent safety switch equipped with fuse. (For a rating-by-rating cost comparison, write to the Westinghouse address shown below.)

Fact: AB-I's require less mounting space. To protect a given motor size, the AB-I breaker will nearly always be smaller (up to 40% smaller, never larger) than an equivalent safety switch.

Fact: AB-I's require no maintenance. No costly fuses to replace; no production time-loss due to fuse replacements; no maintenance of any kind!

Fact: AB-I's are safer. With breaker protection, motors can't single-phase. There are no exposed live parts on an AB-I breaker to endanger workmen; no need to open

the cover to reset the handle; no dangerous fuse replacements.

Fact: AB-I's are more versatile. Only with AB-I breakers can you use convenient, time- and money-saving accessories such as bell alarms, shunt-trips, auxiliary interlocks, etc.

It's a fact. AB-I breakers are the safest, surest, least costly means of circuit protection. On your next order, order the best in AB-I breakers—by Westinghouse.

J-30292

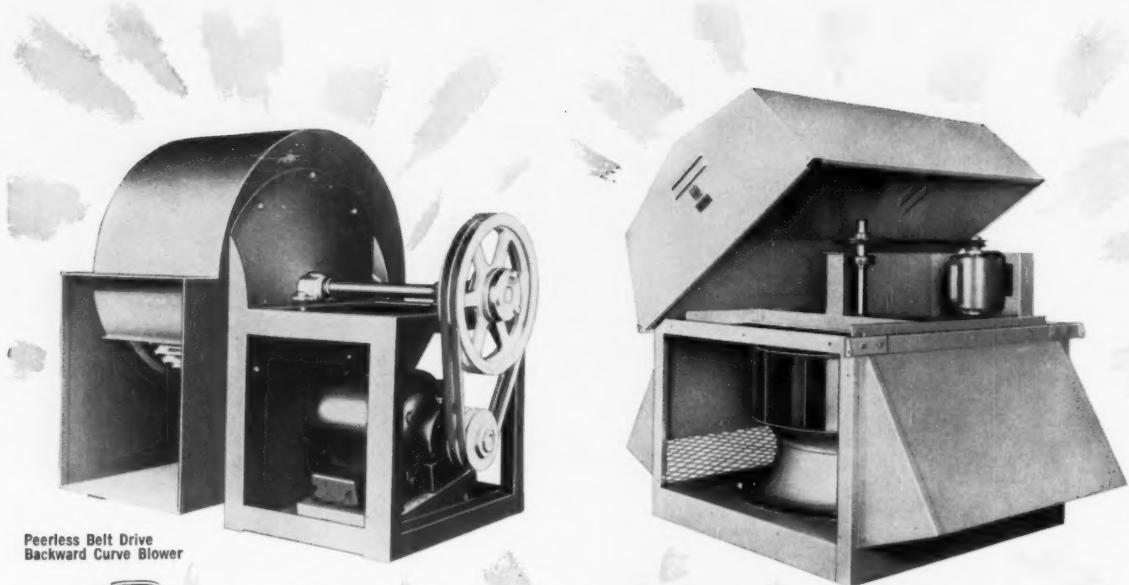
YOU CAN BE SURE...IF IT'S

Westinghouse



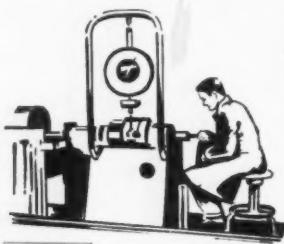
Westinghouse Electric Corporation
STANDARD CONTROL DIVISION
Beaver, Pennsylvania





Peerless Belt Drive
Backward Curve Blower

Peerless Belt Drive
Centrifugal Roof Ventilator



TESTED... AND RATED TO AMCA* SPECIFICATIONS

* The new Air Moving and Conditioning Association formed by merging PFMA, NAFM and IUHA.



As a charter member of AMCA, we are naturally vitally interested in listing and rating our air moving products according to AMCA specifications as set forth in the AMCA code. The products you see here are the two most important, basic products in our expanded line of air moving equipment. Along with other Peerless air moving units, they have been designed and

manufactured to meet all AMCA standards. With this assurance, Peerless air moving equipment can be specified and installed with confidence. When you have an air moving condition which needs solving, call your nearby Peerless representative or the Peerless factory direct. We can all work together in helping you arrive at the best possible solution.

Write today for Bulletins SDA-160, SDA-200 and SDA-220!

A COMPLETE LINE OF AIR MOVING EQUIPMENT



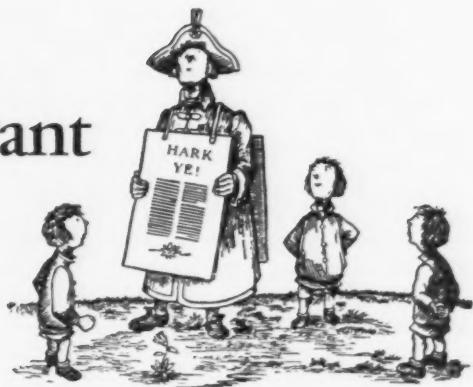
Charter Member of the Air Moving and Conditioning Association, Inc. (AMCA)



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FANS • BLOWERS • ELECTRIC MOTORS



News for the Consultant



Stone & Webster Buys Associated Nucleonics

In a move to broaden its activities in the nuclear field, Stone & Webster Engineering Corp., of Boston, has announced the acquisition of Associated Nucleonics, Inc., of Garden City, Long Island. The Long Island firm, formerly known as Walter Kidde Nuclear Laboratories, Inc., was purchased for a cash consideration from Walter Kidde & Co., and Walter Kidde Constructors, Inc., which formed the research and development unit in 1952.

T. Cortlandt Williams, president of Stone & Webster, said the experienced staff and the laboratory facilities of the Garden City firm will supplement

his firm's Nuclear Projects Division. Wilbur E. Kelley, head of the predecessor organization, will remain as president of Associated Nucleonics, Inc., with Mr. Williams becoming chairman of the board of the new Stone & Webster Engineering subsidiary.

Stone & Webster currently is working on the Yankee Atomic Power plant at Rowe, Mass.; the Carolinas-Virginia reactor project at Charlotte, N.C.; and the 25-billion electron volt synchrotron at Brookhaven National Laboratory. As a subcontractor to Westinghouse, Stone & Webster designed and as-



*In the new, automatic
world you're making ...*

**Your ideas work better
when you work
with HONEYWELL**

More products to give your ideas greater scope. From Honeywell you get a great variety of products both mechanical and electrical. Honeywell is the only company that makes a complete line of pneumatic, electric and electronic controls plus instrumentation for commercial buildings. With Honeywell your choice is wider, your ingenuity less restricted.

More ideas that go with yours. Honeywell has pioneered the concept of central-systems control for commercial buildings, now the accepted trend. This and other Honeywell ideas have increased recognition of the importance of operational equipment, and helped to make your contribution bigger, better and more important.

More support. Honeywell works with you on every job, frees you from annoying details, saves you time, even

helps you sell. And the assistance of Honeywell specialists in each of 112 offices throughout the country is as near as your phone.

Look over the Honeywell products and ideas on the following pages. And, remember, each is backed by the kind of support that only Honeywell can offer you.

**FOR MORE
TO WORK WITH ... WORK WITH
HONEYWELL**

sisted in the construction of the nuclear power plant general facilities at Shippingport, Pa. Previously, Stone & Webster had designed and built the electromagnetic separation plant at Oak Ridge, Tenn., and the entire town of Oak Ridge.

Grating Panels for Sun Control

A new method of sun control for modern architecture has been announced by Irving Subway Grating Co., Inc., New York. The company has made available standard panels of grating for use as sunshades on school buildings and other structures which often require large glass areas for natural lighting.

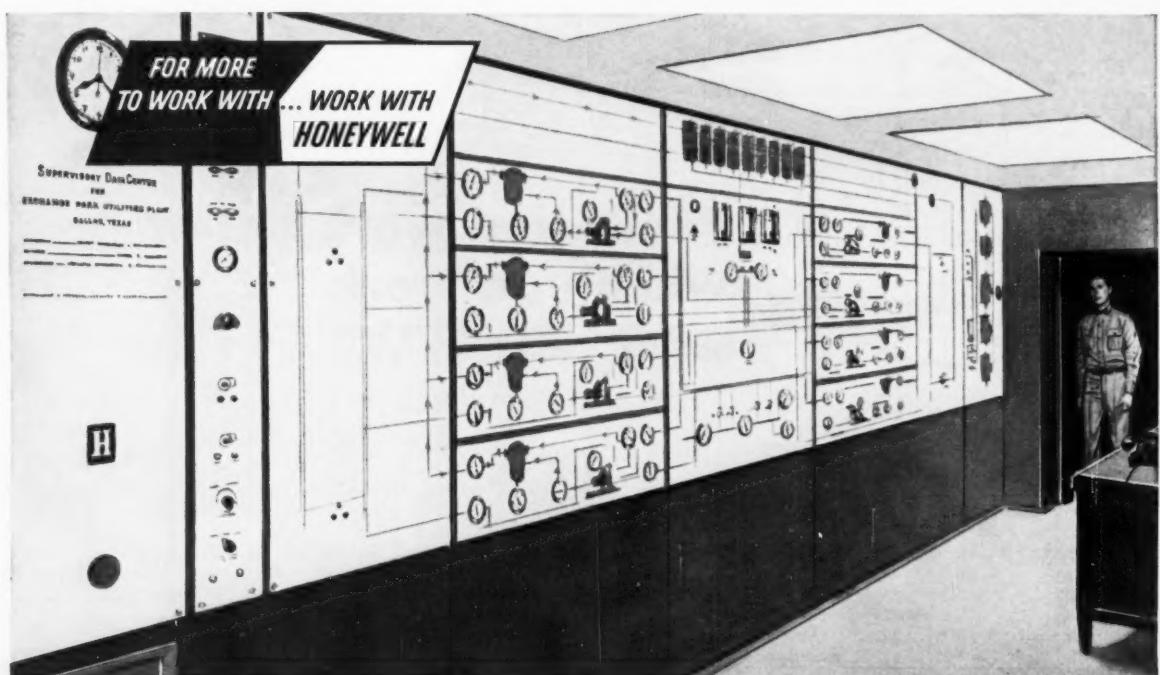
The grating panels substantially reduce cooling costs of completely air conditioned buildings by preventing the sun from generating excessive heat on window glass. Hot air cannot become trapped next to glass; it circulates freely through the open mesh of the grating.

The grating also helps control sky glare from direct sunlight while admitting the maximum amount of daylight. In addition, the grating offers maintenance advantages. It will not collect rain or snow. The panels are strong enough to be used for window cleaning walkways.

Besides the functional advantages, the grating of-



SUNSHADES MADE OF ALUMINUM GRATING ON CURTIS HALL, AT TEMPLE UNIVERSITY, PHILADELPHIA, PA.



The Supervisory DataCenter for the Exchange Park Center in Dallas, Texas, provides an operational check on compressor and boiler pressures for the entire center which will eventually include 4 major office buildings, a department store, 150 retail stores, a thousand-room hotel, an auditorium and a medical center. Each component of the

system is represented in miniature on the 30 foot panel. Owner: Wm. A. Blakely; Engineer: Blum & Guerrero; Architect: Lane, Gamble & Associates; General Contractor: J. E. Morgan & Sons; Mechanical Contractor: Kieffer Plumbing & Heating; Electrical Contractor: Fischbach & Moore.

fers a sun control method which lends itself readily to the aesthetic effects of modern architecture. Further, the grating is versatile in its design capacity since it may be mounted in any plane and is available in a wide variety of mesh patterns, fabricated in aluminum, steel, or other metals.

Prestressed Beam Passes Test

A 67½-ft long prestressed concrete beam recently had to pass a rigorous load test before it and 119 others could be approved for use in the Cleveland Transit System's new \$1.6-million Triskett Garage.

The unusual test was conducted at the request of CTS management because the garage — for storage, maintenance, washing, and fueling of 200 busses — will be one of the largest prestressed structures in the country.

Dalton-Dalton Associates, architects and engineers for CTS, estimates that this prestressed concrete construction will cost 20 percent less than any other method of achieving the required degree of fireproofing. The test was conducted under Dalton-Dalton supervision.

Concrete piers at each end supported the beam. First to be applied was the dead load of 700 pounds per lineal foot, approximately 23½ tons. Gages set at the center and quarter points measured de-

flection of the concrete beam over a 48-hour period.

Then, 160 percent of the uniform live load (the equivalent of 16½ tons) was applied at the center of the beam. Specifications called for a 90 percent recovery after release of the live load. The beam recovered about 92 percent.

The 67½-ft beam was selected as most representative of the beams to be used in the garage. Beam lengths range from 57½ to 100 feet.

State Agency Seeks Consultants

The California State Small Craft Harbors Division was established by the state legislature last summer and has been in operation since October 1957. Its main purposes are to:

- † Assist the cities, counties, and harbor districts in the creation of boating facilities, both along the coast and in the inland lakes and rivers.

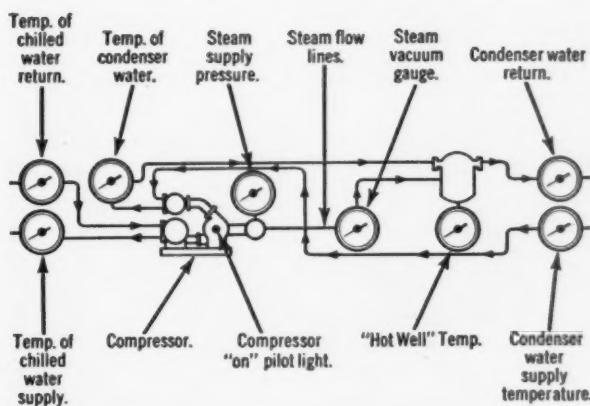
- † Help provide expert engineering and economic consulting services for the local agencies. This generally is restricted only to advice and review of plans.

- † Act as the state agency in negotiating with the Federal government on waterways development problems of the state.

- † Construct and operate harbors or other boating facilities when there is the need and no local agen-

Honeywell Supervisory DataCenter*

Central supervision of air conditioning for a 120 acre park



One of eight steam-driven refrigeration compressor systems depicted in miniature on the DataCenter panel. Other modules on panel provide data on performance and operation of 9 cooling towers and 5 boilers, start-stop buttons and pilot lights for water pumps, temperature selector knob for the heat exchanger, pH meter for condenser water and several alarms, audible and visual.

*Trademark

The 30-foot Supervisory DataCenter panel for Exchange Park is installed in the Utilities Building. It enables the operating engineers to check on the operation of the steam turbine driven refrigeration compressors and boiler plant steam pressures that serve this entire project with steam and chilled water for their respective air conditioning systems. Pilot lights show which equipment is operating. Fluid pressures and temperatures are indicated continuously.

The added efficiency and savings which centralized control such as this offers building owners can be custom designed for your clients. Only Honeywell has the equipment, facilities and experience to develop special panels to suit all buildings. Honeywell Industrial instruments are precise and dependable. Honeywell panel manufacturing facilities are the largest in the control industry. And Honeywell has over 400 centralized control panels, of great variety in operation.

Honeywell
 *First in Controls.*

cies are in position to provide such facilities.

The Division currently is accepting applications for loans to the cities, counties, and harbor districts to assist them in the planning stages only of their waterways projects. Most of these loans will be used by these public agencies for contracts with consultants for harbor planning and engineering.

A file of consulting engineering firms active in this field is maintained at the Division for reference to agencies granted loans from the planning fund. Consulting engineers throughout the United States interested in submitting proposals on this work are invited to file their experience records and brochures with the Division. Correspondence should be addressed to Mr. H. G. Stevens, Chief, Division of Small Craft Harbors, 202 D State Office Building No. 1, Sacramento 14, Calif.

Texas Ethylene Plant "On Stream"

One of the largest single ethylene plants in the world has been put into successful operation at the Sweeny, Texas, plant of Phillips Chemical Co., a wholly owned subsidiary of Phillips Petroleum Co., it was reported by Stone & Webster Engineering Corp. The plant has a production capacity of 180-million pounds annually, and has been so constructed that production can be increased easily to

290-million pounds per year when there is a demand.

Designed and constructed by Stone & Webster, the plant turned out specification products within



AERIAL VIEW OF NEW TEXAS ETHYLENE PLANT.

24 hours after attaining proper conversion levels in the furnaces.

The new plant supplies ethylene through a 70-mile pipeline to Phillips' recently constructed poly-



In a restaurant application, the Honeywell "Renew-Air" Filter has high absorption capacity for such objectionable odors as tobacco smoke, burning fat, fish and others likely to be present. In the past, increased outdoor air intake

was necessary to diffuse these odors, which resulted in higher air conditioning costs. Now Honeywell's "Renew-Air" Filter removes the odors, enables air conditioning to be operated economically with reduced air intake.

ethylene plant at Pasadena, Texas, where it is polymerized into the versatile Marlex plastic. Phillips also sells ethylene to others.

Record Set on Oregon Hydro Plant

A hydroelectric plant project in the State of Oregon, which was engineered and construction-supervised by Ebasco Services, Inc., New York engineering, construction, and business consulting firm, has broken all records for speed of completion.

Production of commercial electricity was turned out by Portland General Electric Company's Pelton project on the Deschutes River in Central Oregon only twenty months and two days after the construction contract was signed in mid-1956. Energy has been moving from the No. 1 generating unit, the first of a scheduled three, each with 40,000 kw capability, into the Northwest power pool. Remaining units are expected to be in operation soon.

Another Long Span

A short distance from the recently completed Connecticut Turnpike's Quinnipiac River Bridge, which outdistances all other girder bridges in the western hemisphere with its 387-ft long center span, construction is scheduled to begin this spring on an

eight-lane structure over the New Haven Railroad's main line and yard just north of the station at New Haven. Utilizing the second longest span, 379 feet, with two similar units of 151.5 feet on either side, it will carry relocated Route 34, New Haven's principal connection with the Turnpike.

Route 34, with frontage roads and frequent access and exit ramps, passes through downtown New Haven and bisects the area now being modernized by the redevelopment agency. It is scheduled for completion in about two years.

Both bridges have been designed by D. B. Steinman, New York consulting engineer. On his plans, the combined projects, including the river bridge, its approaches, and the intricate traffic interchange funneling traffic to New Haven, Boston, New York, and Hartford will cost a total of \$23 million.

Forty-Story Elevator in High Sierras

One of the highest elevators in the West is being installed miles from city skyscrapers, deep in a canyon, in California's Sierra Nevada mountains. The elevator is being installed in the first large-scale underground hydroelectric plant to be built in the United States.

It will be the equivalent in height to a 40-story elevator, but will have only ten stops. And, unlike

For your mechanical systems... Honeywell's "Renew-Air" Filters

Their activated charcoal removes odors, lowers air conditioning cost!



Only the best activated charcoal is used in Honeywell's "Renew-Air" Filters. This charcoal, made from coconut shells, has more pores, more area for absorption. (Roughly, 125 acres per pound.) It is hard and durable, does not dust off or powder in service.

Here's a better, more economical solution to the problem of odors than either masking or diffusion. This new Honeywell Air Filter uses the principle of absorption by activated charcoal to filter return air, reduce the amount of intake air needed and produce savings in air conditioning installation and operating costs.

Combined with the Honeywell Electronic Air Cleaner, this new Air Filter provides air with the highest level of purity and cleanliness possible. Restaurants, hospitals and factories are only a few of the applications where this result is desired.

For convenience in specifying and installing, the Honeywell "Renew-Air" Filter is available in four different sizes and types of cells. These cells are easily removable from the frame for re-activation which Honeywell does at low cost. For further information, contact your local Honeywell office or write Minneapolis-Honeywell, Dept. CO-4-49-5, Minneapolis 8, Minnesota.

Honeywell



First in Controls

elevators in office buildings, the first trip will be down, 500 feet inside the mountain.

Work was begun last year creating a large cavern hewn out of solid granite, 2000 feet inside a California mountain. Access was gained by driving a tailrace tunnel in from the Kings River. The chamber soon will be known as the Haas Powerhouse, housing two turbine generator units driven by water dropping through a nearly mile-long pipe from the outlet portal of a six-mile tunnel.

In providing a shaft for the elevator, ventilation ducts, and other uses, miners first bored a diamond drill hole six inches in diameter, 389 feet from the surface down to the top of the roof of the chamber. Then, they threaded a wire rope down this hole, suspending a cage at the bottom of the small shaft. Sitting in the cage, miners drilled into the ceiling overhead, placing dynamite in the drill holes, and, by stages, exploded a shaft straight up through the granite.

The two generating units in the Haas powerhouse will produce 128,000 kw. In addition to the Haas plant, Pacific Gas and Electric Company's \$80-million Kings River project includes another new powerhouse, the enlargement of an existing powerhouse, and the construction of two large storage dams, 10 miles of tunnels, transmission facilities, and other works.

Computer Service for Consultants

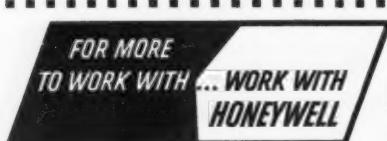
An electronic computer which can reduce costs and save time for the consultant is now available to all members of the Illinois Association of Consulting Engineers. The firm providing the service, Midwest Computer Service, Inc., Decatur, Ill., is backed by seven Illinois consulting engineering firms. Six of these organizations are listed as IACE members or have in their employ individuals who are IACE members.

The new company is headed by E. M. Chastain, of Decatur, as president. Participating firms include Jenkins, Merchant & Nankivil, and Crawford, Murphy & Tilly, both of Springfield; Warren & Van Praag, and Homer L. Chastain & Associates, both of Decatur; Hurst-Rosche, Inc., Hillsboro; Rochester & Goodell, Salem; and Clark, Daily & Dietz, Champaign. Interested IACE members may contact any of these firms for further information.

New York "Liberty Bridge" Proposed

A resolution calling on New York Governor Harriman to hold up the proposed Narrows Bridge for a new project, a direct span between the borough of Brooklyn and New Jersey, was offered in the New York State Legislature.

The proposed new "Liberty Bridge," crossing the



For your mechanical systems...Honeywell Hi Velocity Double-Duct Mixing Box Controls

Now your choice of two constant volume systems

1. Honeywell's new Volumatic* system gives clients dependable, economical, constant volume control of double-duct systems. This control system uses a new type of piston motor with nylon bearings which requires less lubrication. This new Volumatic control system can be applied to all sizes and types of mixing boxes. The sensitive pressure regulator uses a fixed restrictor, error-proof, easier to install and maintain.
2. Honeywell's Duablend* system gives your clients peak performance and minimum maintenance. The Duablend system features *two* pressure regulators to

assure constant volume from *each* duct (under control of space thermostat) regardless of pressure changes. Its exclusive Sub-master pressure regulator provides a similar stabilizing control action to the Sub-master duct thermostat in heating and ventilating units.

The Duablend† system uses the simple Honeywell Air-Balance Valves*. These valves have no mechanical parts to wear and no adjustments. The valves operate on the balance of air pressure on two sides of a flexible diaphragm.

*Trademark

†Duablend formerly termed Air Blender

Honeywell
H Fast in Controls



Upper Bay just north of the Statue of Liberty, would cost \$500 million, according to state senator William F. Conklin who said it would have many advantages over the proposed Narrows Bridge from Brooklyn to Staten Island.

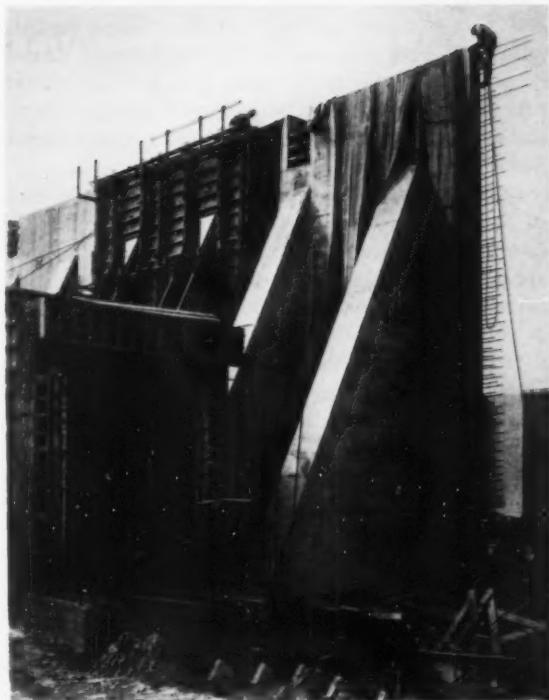
The bridge, as proposed, would connect with the New Jersey Turnpike at a point near the boundary between Jersey City and Bayonne and also would serve Staten Island through an auxiliary spur.

Conklin said the plans for the new bridge came from Henry S. Smith, a manufacturer of Roselle, N.J. He said that D. B. Steinman, noted bridge engineer, had studied the plan and pronounced it feasible. The overwater portion of the Liberty Bridge would be only 400 feet longer than the proposed Narrows Bridge.

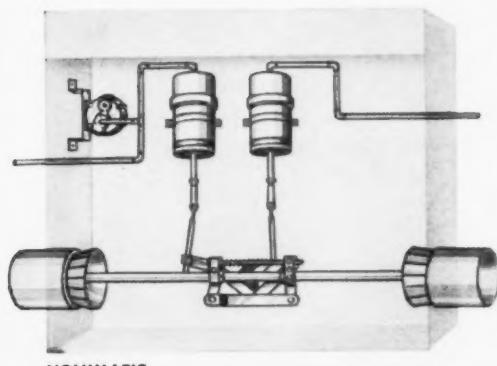
"Concrete Boat" Anchors Power Station

To speed construction of the new 750,000 kw Thos. H. Allen Electric generating station designed by Burns and Roe, Inc., consulting engineers of New York, for the City of Memphis Light, Gas & Water Division, 41-ft high steel forms are being used for retaining walls, pilasters, and counterforts.

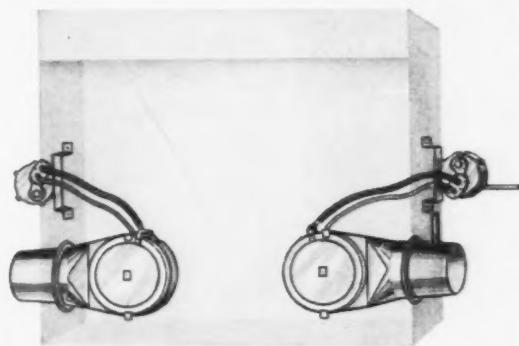
Because the new Memphis generating station is located on the south shore of McKellar Lake, an area subject to flooding by the Mississippi, Burns



SECTION OF SOUTH WALL AND PART OF 4000-FT DISCHARGE TUNNEL FOR MEMPHIS POWER STATION.



VOLUMATIC



DUABLEND

Here's how these two dependable systems work

Volumatic System: 1) Space thermostat operates motor to change ratio of hot and cold air. 2) Pressure regulator in mixed air operates another motor to adjust linkage, increase or decrease total volume from hot and cold ducts. Or, 1) Space thermostat operates motor to control hot duct valve. 2) Pressure regulator in mixed air operates motor to control cold duct valve, maintain constant total volume. This low cost system provides dependable control, is easy to maintain and fits all sizes and types of mixing boxes.

Duabland System: 1) Space thermostat resets Sub-master pressure regulator controlling valve in hot duct. 2) Pressure regulator in mixed air controls the total air volume by operating cold duct valve. 3) Change in flow resulting from changes in hot duct pressure is corrected by Sub-master regulator operating hot valve without disturbing cold. 4) A change in flow caused by changes in cold duct pressure is corrected by regulator increasing total flow operating cold duct valve. Sub-master flow regulator holds hot duct flow constant.

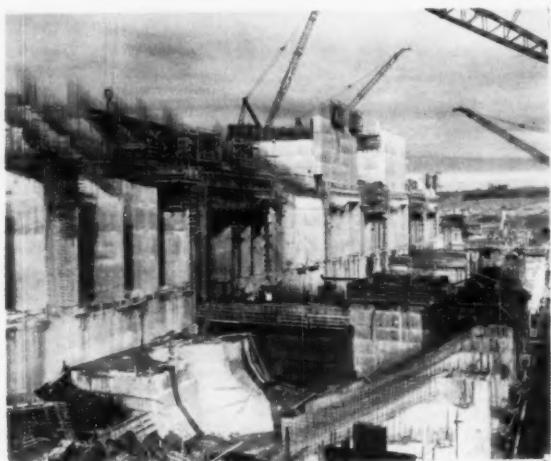
and Roe designed a "concrete boat" anchored to piling to keep the basement from floating during construction, prior to the placing of the superstructure and equipment. Retaining walls are 41-ft high, and are strengthened by counterforts spaced at regular intervals.

Steel forms 12-ft wide permit complete sections of wall to be poured at once, in spans of up to 36 feet. The design and module of the building column spacing provide for counterforts placed on 12-ft centers, so that a minimum of fitting and adjusting is necessary, and the equal column spacing effects maximum reuse of the wall forms. Construction differences, such as spacing of pilasters, or slope and depth of counterforts, are handled by fully adjustable front and back forms.

Steel forms also help in pouring the plant's unusually large and long condenser cooling water intake and discharge tunnels. Constructed of reinforced concrete, these tunnels will carry up to 750,000 gpm, for a distance of one mile. Three intake tunnels each measure 7 feet by 7 feet; the discharge manifold is 10 feet by 15 feet-10 inches. Finally there are some 4000 feet of discharge tunnel, consisting of twin tubes, each 12 feet by 12 feet in cross section. Some 75,000 cubic yards of concrete will have been placed when the Memphis, Tennessee, plant has been completed.

Columbia River Dam

With the project slightly more than one-third complete, work continues ahead of schedule at



POWERHOUSE STRUCTURE RISES AT PRIEST RAPIDS DAM. AT LEFT AND CENTER ARE THE WATER INTAKE STRUCTURES. DRAFT TUBE EXITS ARE ON BOTTOM.

Priest Rapids Dam on the Columbia River in Central Washington, 125 miles southeast of Seattle. The

FOR MORE
TO WORK WITH... WORK WITH
HONEYWELL

A Honeywell Control Master installed in a club would allow the manager to supervise and adjust air conditioning for his entire layout right from his office. Economy is

easier to achieve because heating or cooling can be reduced in unoccupied areas, increased again when needed without any extra trips to the equipment room.

first 11 of the dam's 22 spillway bays are under construction and the water intake structures of the 1025-ft long powerhouse are nearing completion. The power plant will house 10 generators with a maximum capacity of 796,000 kw. Commercial power is expected to come off the line about July 1960.

Merritt-Chapman & Scott Corp., of New York, is building the dam and hydroelectric plant under a \$92-million contract for the Public Utility District of Grant County. Harza Engineering Co., Chicago, are the consulting engineers for the project.

Big Laboratory Under Construction

Wigton-Abbott Corp., engineers and constructors, of Plainfield, N.J., has started work on a modern-styled \$3.5-million research center for the Hooker Electrochemical Co., near Niagara Falls, N.Y.

The center, which will occupy a 61-acre site on Grand Island, initially will contain about 69,000 sq ft of air conditioned laboratory, office, utility, and storage space. These facilities will be housed in a two-story laboratory building containing an administration section together with an adjoining one-story service and utilities wing.

The main two-story building will be 244 by 105 feet in area and will contain 24 laboratory modules, administrative offices, a two-story library, and a

conference room. It also will have facilities for infrared, physical chemical, analytical, and distillation laboratories. Certain laboratories will have precisely controlled humidity. Present plans call for a staff of about 200 personnel.

The single-story section will house a lunch room, glass blowing shop, glassware washing area, central storage, air conditioning equipment, boilers, water treatment facilities, and a receiving area for laboratory supplies. This utility wing has been so located that future expansion will be feasible on both sides of the building.

All areas of the research center have been designed by Wigton-Abbott Corp. to permit considerable future expansion without disturbing the present layout. Among the additional units under consideration for the future are an auditorium and additional laboratories, and office wings. Occupancy is expected by the end of 1958.

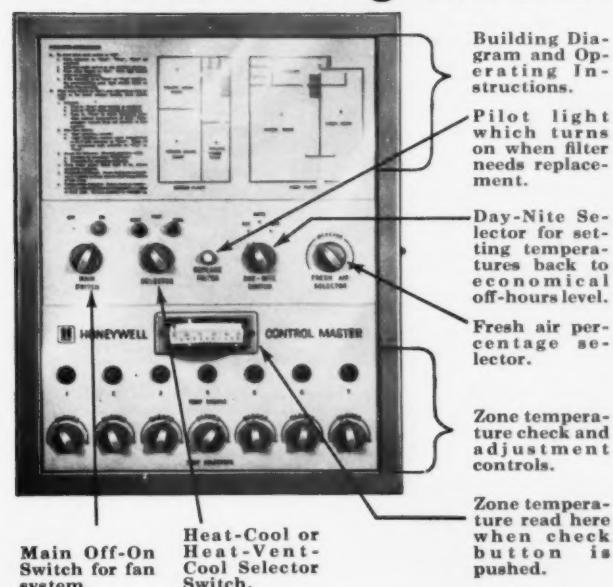
Mobile Generators to Mexico

The last two of five mobile generating plants, permanently housed in tractor-trailer units, have left Springfield, Ohio, for Mexico.

The 500 kw generators, each capable of furnishing the normal power needs of a town of 2500 people, are the first purchased for use in Mexico by

For your mechanical systems...the Honeywell Control Master*

It brings all the advantages of centralized air conditioning control to smaller systems



Building Diagram and Operating Instructions.

Pilot light which turns on when filter needs replacement.

Day-Nite Selector for setting temperatures back to economical off-hours level.

Fresh air percentage selector.

Zone temperature check and adjustment controls.

Zone temperature read here when check button is pushed.

Main Off-On
Switch for fan
system.

Heat-Cool or
Heat-Vent-
Cool Selector
Switch.

Now the economy and efficiency of centralized control for air conditioning is available to all your clients. Shops, restaurants, medical clinics, churches, small department stores and others can get added savings and convenience from their air conditioning when you include a Control Master in your design.

For you, there is no need to repeatedly explain a small air conditioning installation you've designed to the person put in charge. The Honeywell Control Master has clearly identified knobs and buttons with step-by-step instructions right on the panel. Operation is so simple and clearly explained that new operators can take over with a minimum of directions.

For a descriptive brochure on this Honeywell Control Master, including a guide for writing specifications, call your local Honeywell office. Or write Honeywell, Dept. CO-4-49-9, Minneapolis 8, Minn.
*Trademark

Honeywell

 First in Controls

the government's Comision Federal de Electricidad.

Completely self-contained, the mobile power plants are built for continuous output. They will be used to bring power to new areas, help in re-routing existing power lines and systems, and handle peaks in power needs across Mexico.

Purchase of the units is in keeping with Mexico's determination to provide an adequate supply of electricity for the growing industry and commerce of the nation. The additional power will also aid the government's program of rural electrification.

The generators are built into trailers 32 feet long, eight feet wide, and 12½ feet high, especially strengthened in chassis and sides.

A spokesman for the Mexican firm said the generators will be used to provide additional power in areas where demands have expanded beyond the capacity of transmission lines. These units will serve as the sole power source as new lines replace old in the power expansion program.

Highway Engineers Photocopy Deeds

The use of a portable photocopier, the Contoura-Portable, enabled a New York firm of consulting engineers to speed deed copying on a recent highway project. The engineers estimated that the machine cut costs 40 percent.

Faced with the problem of surveying all of the properties along a section of the New York Thruway, the engineers looked for a new technique to speed copying of the masses of records required.

The assignment began with the initial surveys of all properties, with necessary relocations as needed to meet existing conditions. Their work included mapping, checking, determining grades, curves, and widths. They also had to design the substructures and secure State approval for the final plans.

Mapping the boundaries of each property required deed descriptions, which had to be found in the Land Records at the Courthouse. Then, to enter all of the properties on the right-of-way on the section map, the deed descriptions had to be copied from the Land Records and brought back to the office for further processing.

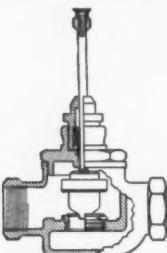
Using the portable photocopier to reproduce the deed descriptions in the Land Record books, the engineers were able to omit entirely the copying of deed descriptions by hand.

The machine is placed upside down on the open books. A plastic inflatable air-cushion follows the contours of the curving pages from margin to margin, permitting rapid photo-copying.

By this device, photo-exact copies of the necessary deeds were made at the rate of eight seconds per page. In an additional 22 seconds each of the copies

For your mechanical systems...New Honeywell Pneumatic Valve and Motor

New materials...new designs increase performance for control of steam or water



Valve features!

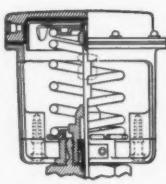
Equal percentage throttling plug plus longer stroke gives better control of steam or water flow at light load.

Exclusive Teflon Cone packing lowers friction, lasts longer, requires less lubrication. Easier to change because it comes out with packing nut.

Spring loaded stem and disc holder connection eliminates noise and wear, lasts longer.

Plug type throttling guide eliminates "pocking" of discs due to impingement of fluid through old V Port types.

Packing nut design eliminates periodic tightening, impossible to over-tighten.



Actuator features!

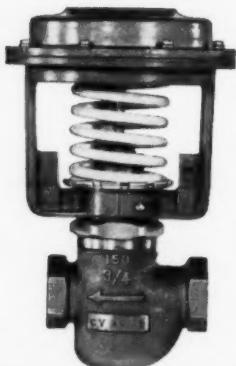
Diaphragm design gives more power for smaller diameter. Saves space, positions valve better, gives high close-off ratings. Larger diameter spring eliminates buckling, doesn't rub stem.

Tough Neoprene diaphragm gives longer wear, in normal temperature use. (Silicon available for extremely high temperatures.)

Quick stem-release slide makes actuator easy to remove from valve to change size or to service.

Normally open and normally closed actuators easily interchangeable. Sizes interchangeable, too.

All parts corrosion resistant.

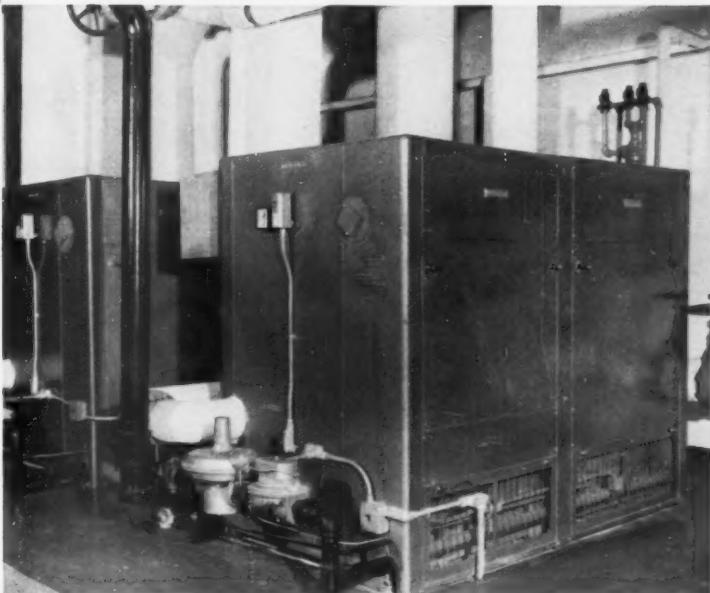
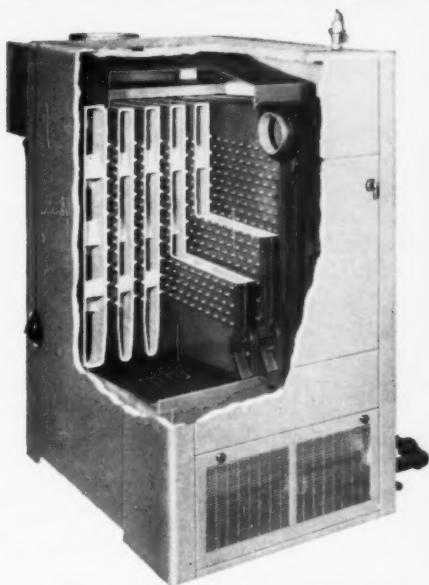
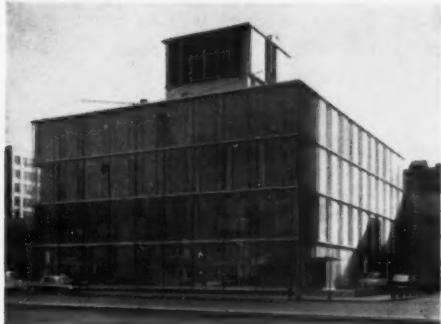


Single seated or three-way valves available in a complete range of sizes. For more information, call your local Honeywell office.

Honeywell



First in Controls



NEW FEATURES!

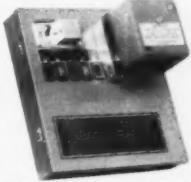
EASY-FIT HEADER

Assures correct header piping for proper steam development and release. Equipped with Dresser compression fittings—offers all the advantages of a swing header without the added erection costs. Machined and pre-fitted at the factory—shipped partially assembled, with all parts clearly marked for easy erection.



ELECTRONIC CONTROL PANEL

Reduces electrical work to a minimum. With its compact grouping of identified components, visual indication of operation and easily understood operating instructions, this electronic control assures lower installation cost and correct operation of the boiler.



Installation of Weil-McLain Type J-18-W Gas Boilers in
A. F. L. Medical Center Building, Philadelphia, Pa.

Architect:
Louis I. Kahn, Philadelphia, Pa.

Mechanical Contractor:
Edward F. Roberts Co., Philadelphia, Pa.

Mechanical Engineer:
A. Ernest D'Ambly, Philadelphia, Pa.

Distributor:
Peerless Penna. Co., Philadelphia, Pa.

The selection of Weil-McLain Type "J" Gas Boilers for this installation assures heating efficiency as outstanding as the modern styling of the building.

In every detail, the "J" Boiler is designed to achieve economy! Not only in fuel consumption but in all the factors which contribute to low cost operation.

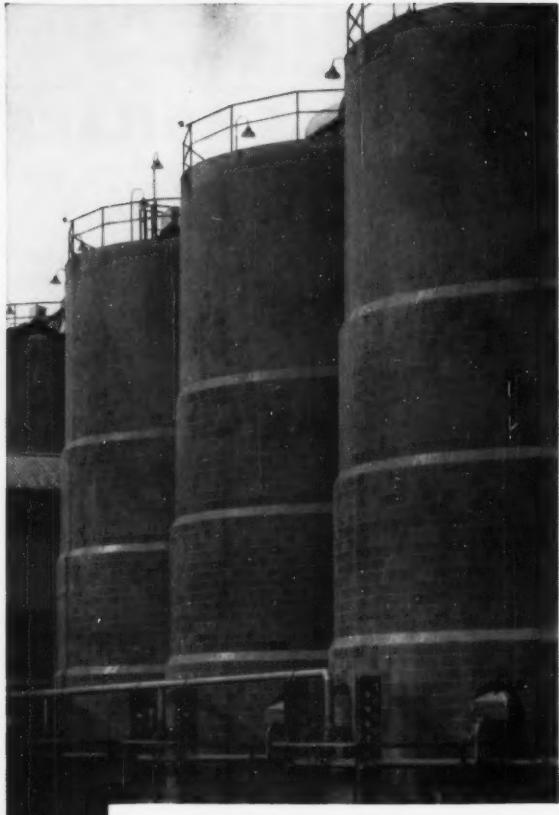
This boiler is *cast iron*—for long life and minimum repairs and maintenance. It is *compact*, requiring less floor space and head room. Assembly with short, multiple draw rods shortens erection time—assures a strain-free boiler. Its handsome jacket is completely insulated.

The Weil-McLain Type "J" Boiler burns all gases, including LP and LP-air and is equipped with controls for completely automatic, safe operation.



WEIL-MCLAIN COMPANY.
MICHIGAN CITY, INDIANA

Address literature requests to Dept. DD-48



Portion of battery of Semtile tanks for storage of 250,000 gallons of slurry each.

DESIGN

by our own engineering staff

INSTALLATION

by our own construction crews

MAINTENANCE

by our own service specialists

of Corrosion-Resistant

LININGS and TILE TANKS

Designed and installed to meet the exact chemical and physical requirements of each installation, Stebbins linings and tile tanks are famous for their efficiency and economy.

Wherever you are — whatever your corrosion-resistance problem may be — it will pay you to take advantage of Stebbins' unequalled experience and facilities.

Write for Bulletin A-153



STEBBINS Engineering and
Manufacturing Company

WATERTOWN, N.Y. • PENSACOLA, FLORIDA

STEBBINS ENGINEERING CORP. — TOWER BLDG., SEATTLE, WASH.
CANADIAN STEBBINS ENGR & MFG CO. LTD. — TOWN OF MOUNT ROYAL, MONTREAL 2, CANADA

was processed. Copies of over one hundred deed descriptions were made in an afternoon — and in a week the entire job was done.

Modern Air Force BOQ

Concept drawings for a multistory officers' quarters building to be constructed at Mather Air Force Base, Sacramento, have been approved, according to Colonel A. E. McCollam, Chief of the U.S. Army Corps of Engineers office in Sacramento, Calif. The Corps of Engineers is the design and construction agency of the U. S. Air Force.

Designed to combat the rising costs of land and site development, the new structure will be eight stories high and will accommodate 408 men. The construction will be of exposed concrete with aluminum windows and louvers for sun control and will contain more than 160,000 sq ft. The cost of the project is expected to be approximately \$3 million. The entire facility is being designed to stay within the current Congressional cost limitation of \$7500 per man for projects of this type.

The project was originally designed as a series of two-story buildings, each housing 40 men, but the cost of developing site utilities and roads made the total project too expensive to construct. The new building, a prototype for possible future construction at other Air Force installations, was planned, designed, and engineered by Daniel, Mann, Johnson & Mendenhall, Los Angeles architects and engineers. The structure is based on Air Force Definitive Drawings from this firm.

The building contains 204 living and sleeping suites designed to accommodate two men. Many of these units have two bedrooms, a living room, bathroom, and provision for a kitchenette. Fourteen of the suites will be made available for transient guest accommodations.

In addition, the structure contains administrative facilities including lobby and lounge areas. Two automatic elevators service the building and a service ramp leads from the street level to the basement which has space for storage and utilities.

All electrical, plumbing, and air conditioning equipment is located in the basement and the utilities will run through the building in vertical type chases. The heating and cooling system has been designed to keep a balanced temperature and each room will have a thermostat so that individual occupants can maintain their own desired temperature both summer and winter.

Parking facilities for 408 cars are provided on the site. The site planning includes provisions for the future construction of two identical buildings. Construction bids for the first building are expected to be asked in October 1958.



Striking, pleasant accent for an up-to-date building corridor: Sylvania recessed lighting troffers continuous-row mounted with acoustical ceiling materials.



Individually mounted troffers, imaginatively arranged, combine attractive design with good basic light distribution for company cafeterias and lounges.



Ribbons of light—Sylvania recessed troffer lighting can be mounted in continuous rows and spaced for high lighting levels in modern business offices.

Introducing . . .

a new Shallow Troffer Series by Sylvania— recessed lighting for today's building methods

For the aesthetically minded lighting designer or installer, who has to cope with the modern trend to lower ceilings and shallower plenum spaces . . . here is a new approach to recessed lighting. It's Sylvania's new Shallow Troffer Series, fixtures which measure only 5½" from top to bottom—and, in many cases, require no additional depth for mounting.

Available in a variety of models, in both one- and two-foot widths, the

Sylvania Shallow Troffer makes this popular form of lighting *practical and usable* in all new buildings, with full illumination efficiency. The units are fully recessed. Unsightly latches are hidden. Even the hinges don't show . . . only the clean straight lines of the frame and attractively styled shielding.

Sylvania Shallow Troffers are carefully engineered to utilize the full plenum space. Lay-in type troffers are provided

for Z-spline and inverted-T ceilings. Exclusive *snap-up hanger* provides quick, secure mounting for most other types of acoustical ceilings (see sketches below). Ask your Sylvania Fixture Specialist for full details, or write direct for FREE new folder of specification data.

SYLVANIA ELECTRIC PRODUCTS INC.
Dept. D32, Lighting Division—Fixtures
One 48th Street, Wheeling, W. Va.

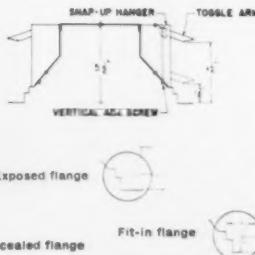
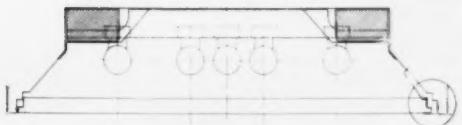
 **SYLVANIA**

Fluorescent Lighting Fixtures and Systems

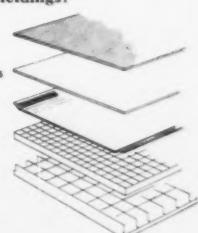
Best fixture value in every price range

New 5½" high troffer utilizes full plenum space. Exclusive *snap-up hanger*, with vertical adjusting screw, provides secure side-mounting for acoustical ceilings with support elements parallel to troffer. End-mounting brackets also available.

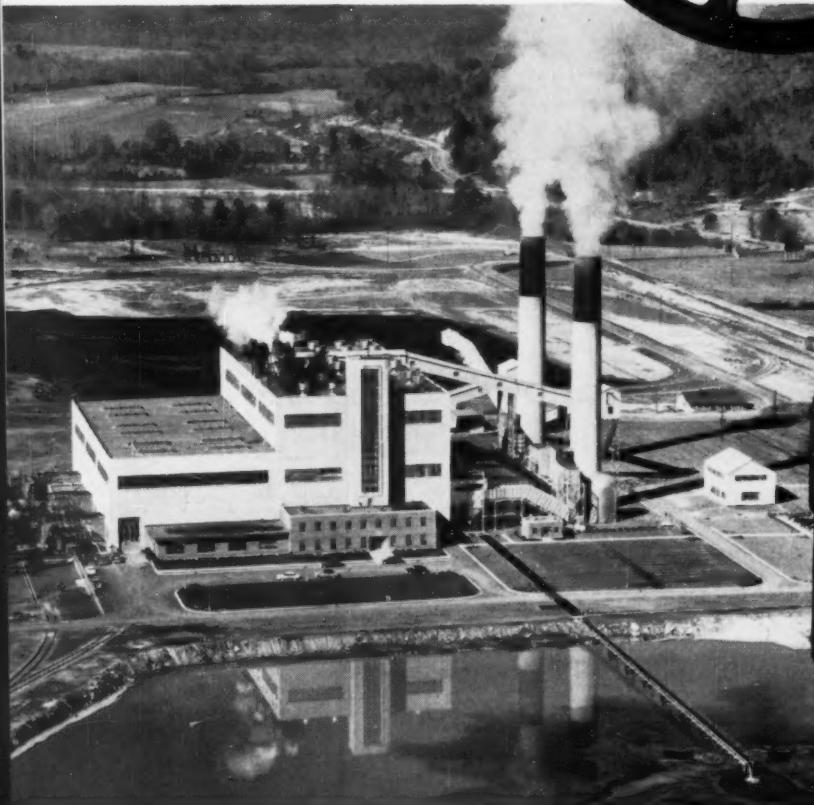
3 models offered to fit all types of ceiling systems:



All standard troffer shieldings:



In All



Hammond Plant near Rome, Georgia. Three
100,000 KW steam-electric units are in operation.

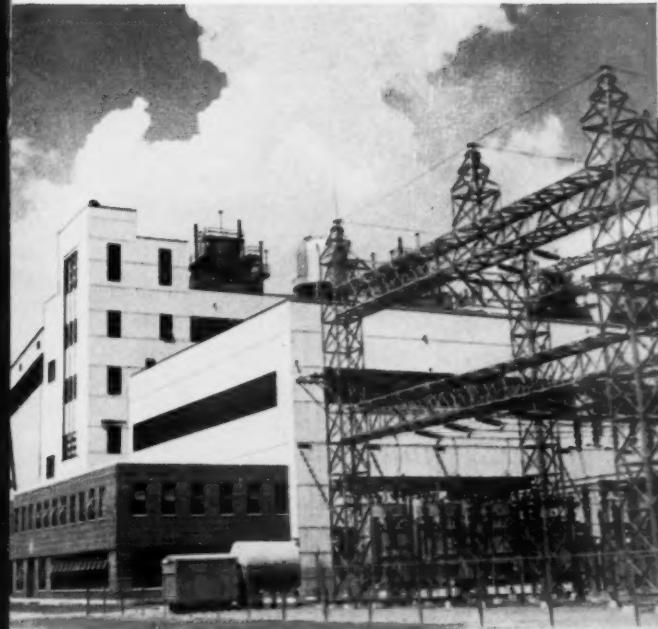
14" Alloy Steel Gate Valve
Pressure Seal Type
Geared Head Operation.

14-1500
CHAPMAN
STEEL

16 Steam Generating Units

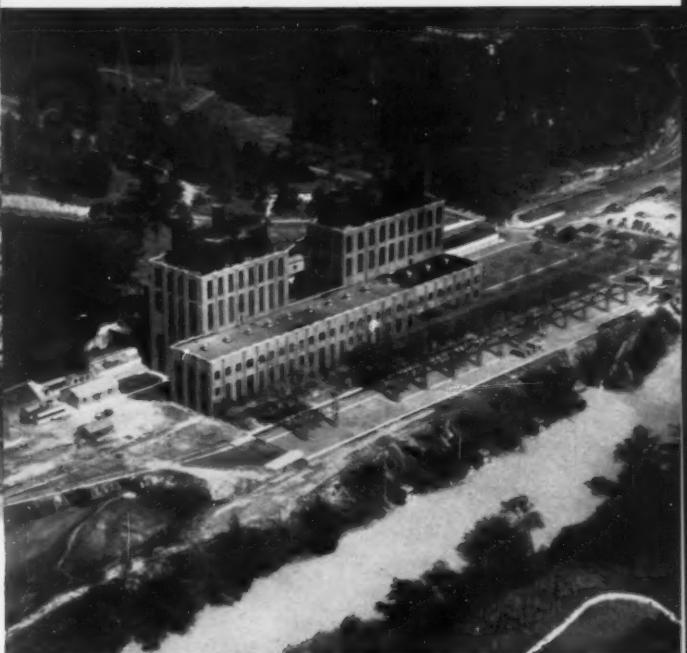
CHAPMAN VALVES

*do their part to serve
the Citizens of Georgia*



Yates Plant near Newman, Georgia. Three 100,000 KW and two 125,000 KW steam-electric units in operation.

Plant Atkinson at Atlanta. Four 60,000 KW units in operation.



You'll find 16 generating stations of the Georgia Power Company located throughout that great state. More units are constantly being added. Total capacity of this huge system, existing and under construction, is 1,843,680 kw . . . an extensive service to the citizens of Georgia.

In every one of the 16 generating plants, engineered by Southern Services, Birmingham, Alabama, you'll

find Chapman High Pressure Valves playing their part.

These valves have been selected for many of the major services in each of these plants because they give excellent continuous service under severe operating conditions. They meet the growing demands of increased temperatures and pressures which are requirements for modern power plant operations.

*The **CHAPMAN** Valve Manufacturing Company*
INDIAN ORCHARD, MASSACHUSETTS

*Looking ahead. When it comes to valves, if you are looking ahead to tomorrow's requirements talk with the Company that is looking ahead . . . Chapman Valve Manufacturing Company. Chapman will plan with you, work with you, *produce for you*. Chapman has the engineers, metallurgists, experience and manufacturing facilities to design, develop, build and test the valve equipment you need no matter how tough the requirements. Write and we'll gladly consult with you.*



Men in Engineering

A new firm, Stadler Hurter International, Ltd., with offices located at 1501 St. Catherine St. West, Montreal, has been formed to take over all the work formerly undertaken outside of Province of Quebec by Stadler, Hurter & Co. Officers of the new company are: A. T. Hurter, P. E., president; A. M. Hurter, P. E., vice president; and N. C. Laflamme, secretary-treasurer. Stadler, Hurter & Co. will continue to practice in the Province of Quebec as in the past.

DRY and CLEAN AIR at the RIGHT TEMPERATURE

- to control your product quality
- to protect a critical operation
- to protect apparatus from moisture damage
- to DRY your material or product
- to control packing or storage conditions
- to assure precision in testing or research
- to increase air conditioning capacity

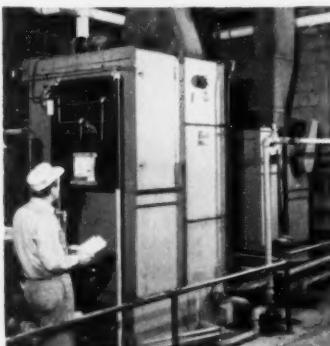
Air Condition by the NIAGARA Method
Using HYGROL Liquid Absorbent

This compact method, giving high capacity in small space, removes moisture from air by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the air.

Most effective because... it removes moisture as a separate function from cooling or heating and so gives a precise result, and always. Niagara machines using liquid contact means of

New officers of the firm of Mead and Hunt, Inc., of Madison, Wis., are as follows: Harold W. Mead, president; Henry J. Hunt, vice president; Earl A. Krueger, treasurer; and Leo F. Pratt, secretary.

Rader and Associates, Engineers and Architects, of Miami, Fla., has opened an office in Quito, the capital of Ecuador. The staff in this office includes: C. L. Lucas, project engineer; John S. Bristol, highway design engineer; Elmer L. Haynes,



drying air have given over 20 years of service. The apparatus is simple, parts are accessible, controls are trustworthy.

Most reliable because...the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions... no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.

Most flexible because...you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

*Write for Bulletins 112 and 131 and complete information
on your air conditioning problem.*

NIAGARA BLOWER COMPANY

Dept. CO-4, 405 Lexington Ave., New York 17, N.Y.

Niagara District Engineers in Principal Cities of U.S. and Canada

highway construction engineer; Marc J. Sakellarios, structural engineer; W. L. Frederick, maintenance engineer; S. Steve Gulbalis, soils and materials engineer; Aubrey H. Michael, equipment superintendent; and J. Lombardy, accounting administrator.



G. T. Shannon has been elected to the board of directors, and Calvin McCormick has been elected vice president of Walter Kidde Engineers Southwest, Inc., a division of Walter Kidde Constructors, Inc., engineers and builders, of New York and Houston.

Wilbur S. Roberts, Jr. has been appointed manager of the New Business Division of Stone & Webster Engineering Corp., engineers and constructors of New York and Boston. Mr. Roberts will coordinate the new business activities of Stone & Webster's offices in Chicago, Houston, Los Angeles, San Francisco, and Seattle.

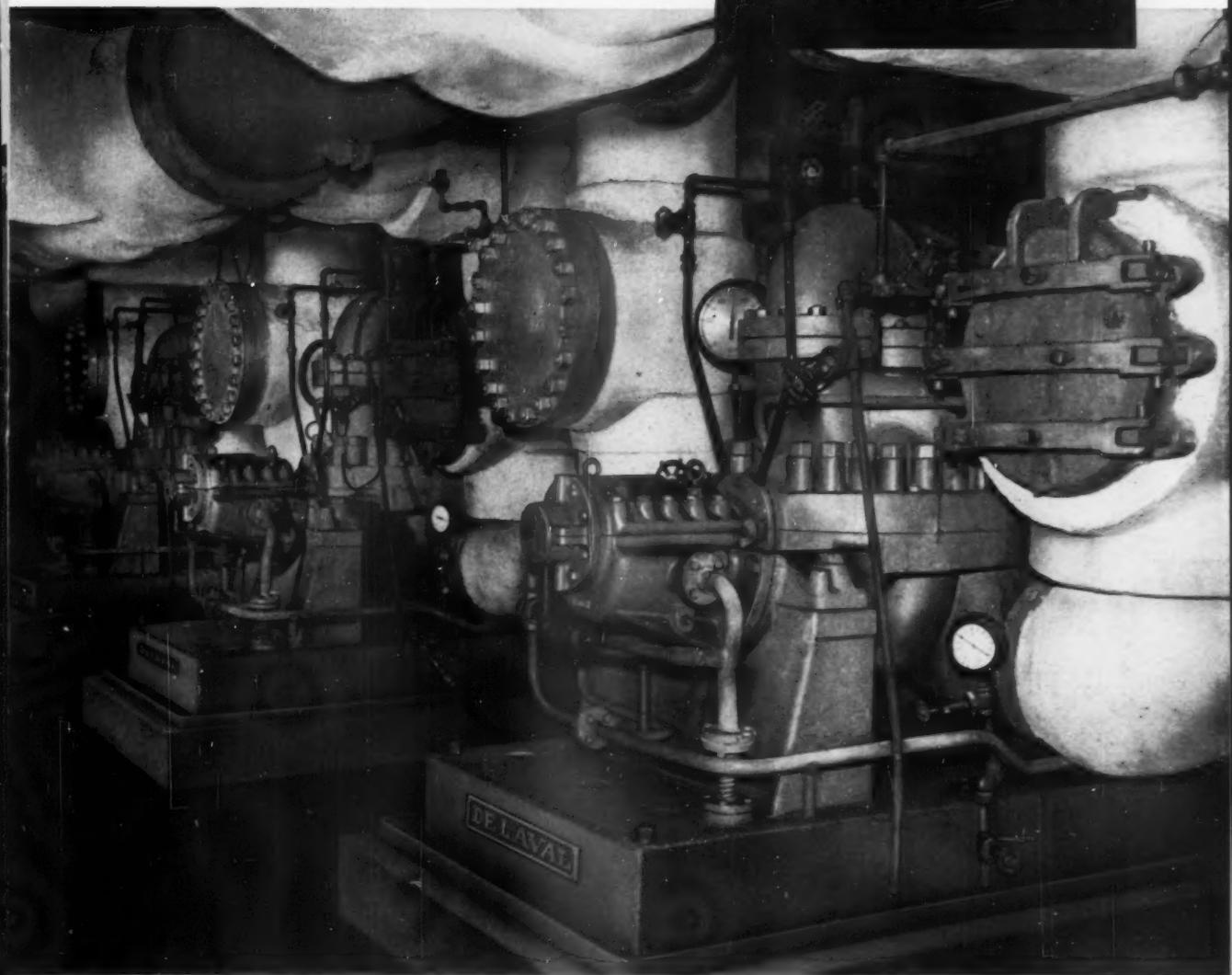


New president of the American Institute of Mining, Metallurgical, and Petroleum Engineers is Dr. Augustus B. Kinzel. Dr. Kinzel, who

Con Edison reorders

DE LAVAL

BOILER FEED PUMPS



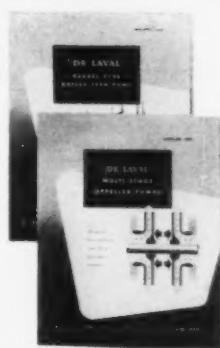
The three De Laval Oppeller Pumps, shown in the photograph, do a dependable job of handling boiler feedwater at the East River Station of the Consolidated Edison Co. of New York. These three-stage pumps, with double-suction in the first stage, have a capacity of 2,000 gpm and operate at a discharge pressure of 620 psig. As proof of their reliable performance, Con Edison has ordered two identical units for the expansion of this station *plus* similar pumps for their Indian Point nuclear generating station.

Excellent for medium pressure and temper-

ature service, De Laval Oppeller Pumps are designed with opposed impellers that balance axial thrust. Standard design features include sleeve bearings and labyrinth wearing rings which assure long economical service.

For high pressure, high temperature boiler feed service, De Laval offers the barrel-type pump . . . a single-suction, radially split diaphragm type multi-stage pumping unit inside a forged steel barrel.

For more data on these dependable pumps, write for Catalogs 1502 and 1506



DE LAVAL Boiler Feed Pumps

DE LAVAL STEAM TURBINE COMPANY

894 Nottingham Way, Trenton 2, New Jersey

is vice president of Union Carbide Corp., succeeds Grover J. Holt, of Ishpeming, Mich., assistant to the president of The Cleveland Cliffs Iron Co. During the past year, Dr. Kinzel has held the offices of president-elect and director in AIME. He also has been a vice president of the Institute and formerly was chairman of its Finance Committee.

The American Institute of Electrical Engineers, at its Winter General Meeting in New York City, nominated L. F. Hickernell, vice president-engineering, Anaconda Wire & Cable Co., as 1958-59 president of the society. Also nominated were six district vice presidents, three directors, and a treasurer.

Vice presidential nominees are: Lynn C. Holmes, Stromberg-Carlson Co.; Joseph R. Kerner, Westinghouse Electric Corp.; Robert B. Gear, Commonwealth Edison Co.; Ingwald T. Monseth, Westinghouse Electric Corp.; John M. Nelson, Seattle City Light; and Warren H.

Chase, Ohio Bell Telephone Co. Nominated to be directors were: William A. Lewis, Illinois Institute of Technology; Norman F. Rode, Agricultural & Mechanical College; and Eugene C. Starr, Bonneville Power Administration.

The nominee for treasurer is C. H. Linder, General Electric Corp. Nelson S. Hibshman, secretary of the Institute since 1954, was re-nominated.

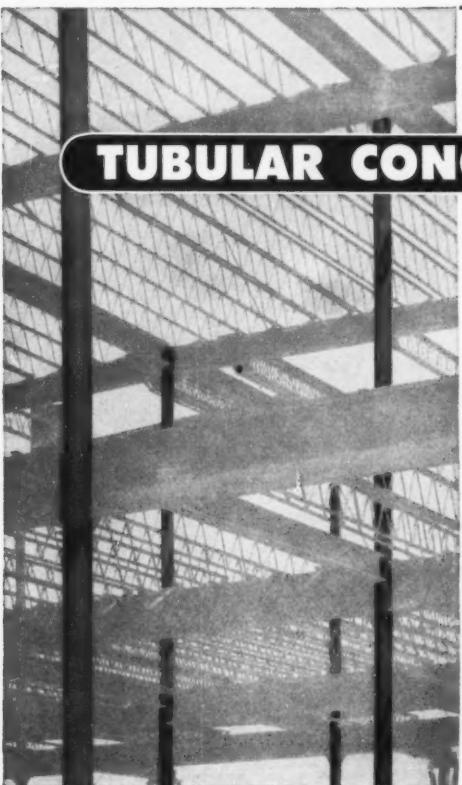
Results of the mail vote of the membership of the Institute will be announced at the Summer General Meeting in Buffalo, N.Y., June 23.

The Board of Directors of Rochester and Goodell Engineers, Inc., Salem, Ill., at their annual meeting created the office of Chairman of the Board and elected four employees officers of the Corporation. The new officers are: Warren B. Goodell, chairman of the board; Frank M. Rochester, president; Colonel Warren Heilig, vice president and general manager; Howard

Bateman, vice president and highway consultant; Earl Moldovan, secretary and chief engineer; and William Spain, treasurer and office engineer.

The Instrument Society of America has announced the appointment of two new officers to improve services to its rapidly expanding membership. Ralph M. Stotsenburg, of Moorestown, New Jersey, has assumed the position of Director of Section Activities to ISA National Headquarters in Pittsburgh, under supervision of Executive Director William H. Kushnick. Thomas K. Hodges, 39, of Pittsburgh, has been named Director of Information on the National Headquarters staff of ISA.

Jack E. Mitchell, P.E., and Leonard J. Gordon, P.E., have merged their operations to form the firm of Mitchell-Gordon Associates, Consulting Engineers, with offices at 302 Bird Road, Coral Gables, Fla. ▲▲



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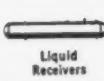
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STONY CREEK, VA. Small job, small budget. But the railing had to be attractive, easy to install, and permanent. Flynn aluminum railing and posts filled the bill perfectly, even to special railing-end design.



HAMPTON ROADS, VA. Flynn railing and posts arrive at the site on schedule to keep pace with other construction operations. No elaborate unloading or storage setup needed—weather can't hurt these parts.



PHILADELPHIA-GLOUCESTER. New Walt Whitman Bridge between Philadelphia and South New Jersey uses Flynn aluminum railing sections of the baluster type. Only two men are needed to install them.

Flynn aluminum bridge railing

These seven recent installations of Flynn bridge railing help prove the versatility and economy of lightweight Flynn aluminum components. From the largest to the smallest job, Flynn railing, rail seats, castings, anchor bolts—all made from aluminum alloys of the highest quality—are delivered as specified and when needed. When it comes to railing on your next bridge or highway job—ask *Flynn* first.

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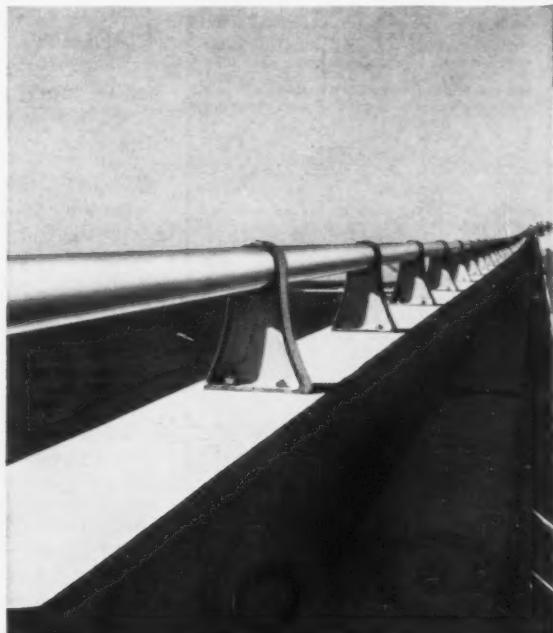
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EXTRUSIONS



McARTHUR CAUSEWAY, FLA. Attractive Flynn railing and posts can be obtained in a wide variety of styles to fit any landscape, save design time and money, enhance the beauty of the surroundings.



WILMINGTON, DEL. This new Walnut Street drawbridge in Wilmington has a combination of round and rectangular Flynn railings. Installation is made easier by precise fitting of bolt holes between parts.



GARDEN STATE PARKWAY. Beesley's Point bridge on the new north-south New Jersey artery, another large project where a few men, without cranes or lift trucks, did the whole Flynn installation job swiftly, economically.

NEW PRODUCT



BARNSTEAD "MF" SUBMICRON FILTER FOR REMOVAL OF PARTICLES TO 0.45 MICRON

This new Barnstead "MF" Submicron Filter for either distilled or demineralized water, has been developed to remove sub-microscopic particulate matter which may cause trouble in some of the new processes in electronic and nucleonic fields. The Barnstead "MF" Submicron Filter will filter out particles as small as .000016 inches, thus permitting a filtering technique not before possible on a production basis.

Each Barnstead "MF" Filter plate can filter up to 100 gallons per hour. Multiple plates can be employed to obtain larger flow rates.

Write for new bulletin #141 to the Barnstead Still & Demineralizer Company, 44 Lanesville Terrace, Boston 31, Massachusetts.

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Every consulting engineer should know that old-style pipe coils are obsolete. They are usually much too costly. They occupy too much space. They are too inefficient and uneconomical. You should learn all about the

DEAN. THERMO-PANEL COIL

which is far superior in every way to pipe coils.

We show here how the Dean Thermo-Panel Coil is made. Two sheets of metal are welded together after the sheets are embossed, as shown. The embossing form flow channels for steam, hot water, or other heating medium, or for refrigerant when the panel is used for cooling. When only one of the sheets is embossed the panel can be curved for use on cylindrical tanks, drums, cans, etc.



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We shall be glad to send one or both of the bulletins below. Check the square or squares, clip out and mail with your name, and address. If you need help call on our specialists.

- Bull. 355. 52 pages. Technical Data
- Bull. 258. Design and Price Information. Backed by 20 Years of Panel Coil Manufacturing

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New Projects Reported

By Consulting Engineers—

ALABAMA

Donald Mills, Consulting Engineer

Selma, Alabama

Water filtration plant, elevated tank, and extension of mains, York, Ala. (civil) \$200,000. Client, City of York.

CALIFORNIA

Harold A. Wright,

Electrical Engineer

San Francisco, California

Superior Cheese plant, Richmond, Calif. \$200,000. Client, Industrial Design Division, Safeway Stores, Inc., Oakland, Calif.

Regal Ice Cream plant, Richmond, Calif. \$550,000. Client, Industrial Design Division, Safeway Stores, Inc., Oakland, Calif.

Wilsey & Ham, Consulting Engineers

Millbrae, California

Warehouse with manufacturing and office facilities, Millbrae, Calif. (civil, struc., mech., elec.) \$175,000 (est.). Client, Benjamin Electric Manufacturing Co.

Mackintosh & Mackintosh

Los Angeles, California

4-story and penthouse store and basement garage. \$500,000. Client, Sidney Eisenstat & Associates, Arch.

Office building and parking structure. \$1.5 million. Client, Welton Beckett & Associates, Arch.

George F. Nicholson,

Consulting Engineer

Long Beach, California.

Offshore oil drilling island and wharves. \$2.5 million. Client, Monterey and Texas Oil Co.

J. Marx Ayres

Los Angeles, California

Pacific Ocean Park, Inc., Santa Monica, Calif. "Oceanic Wonderland," 30-acre amusement center with porpoise, seal, and fish displays, utilizing sea water and fresh water fountains, waterfalls, special rides, cafeterias, shops. (mech.) \$7 million (est.) Client, William D. Coffey, Structural Engineer.

Southern California dental hospital, Los Angeles, Calif. 80-bed, 3-story hospital. \$1 million. Client, Kegley, Westphall & Arbogast, Arch.

Southern Federal Savings & Loan Building, Los Angeles, Calif. 6-story office building. (mech.) \$1.2 million. Client, J. E. Dolena, Arch.

COLORADO

R. L. Whittlesey & Associates

Denver, Colorado

Mesa County courthouse addition, Grand Junction, Colo. Air conditioning, heating, plumbing. (mech.) \$300,000, mech. \$80,000. Client, Van Deusen & Bliska, Arch.

George McMeen elementary school, Denver, Colo. Heating, ventilating, plumbing, lawn sprinkling. (mech.) \$500,000, mech. \$125,000. Client, C. Francis Pillsbury, Arch.

School for Crippled Children, Denver, Colo. Heating, ventilating, plumbing, boiler plant. (mech.) \$370,000, mech. \$80,000. Client, Edwin A. Francis, Arch.

University of Denver student center and dormitories. Heating, ventilating, plumbing. (mech.) \$1,497,000, mech. \$241,000. Client, Edwin A. Francis, Arch.

IB Falk Jorgensen, Consulting Engineer

Denver, Colorado

Hotel, Boulder, Colo. \$3 million. Client, James M. Hunter, Arch.

Park Manor apartment (7 stories), Presbyterian Hospital, Denver, Colo. \$1 million. Client, Carl Groos, O'Neil Ford & A. B. Swank, Arch.

CONNECTICUT

Robert S. Loomis, Engineers

Windsor, Connecticut

Washington Street school, Manchester, Conn. \$260,000. Client, Willard Wilkins, Arch.

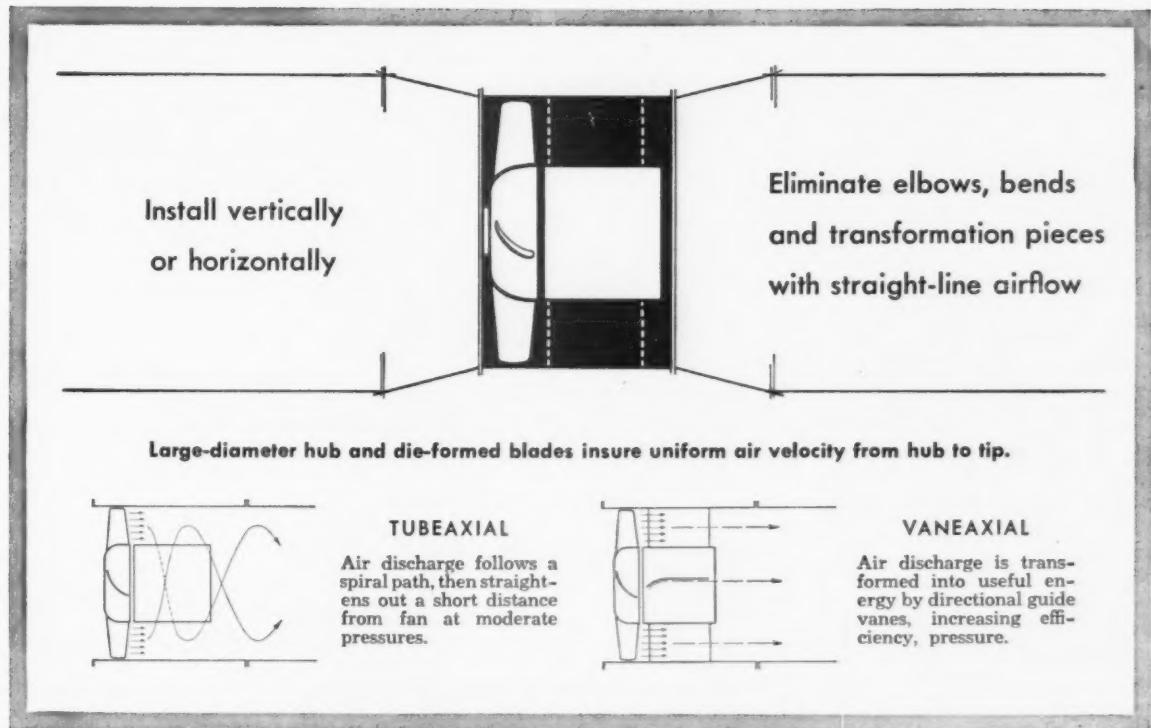
Beth El school addition, Torrington, Conn. \$82,000. Client, Kane & Fairchild, Arch.

DELaware

Daniel Koffler and Associates

New Castle, Delaware

Housing development, Newark, Del. Group of 12 contemporary houses on a hillside site, cantilevered on all sides. Foundations of poured concrete with first floor slab of precast concrete block and deck roof.

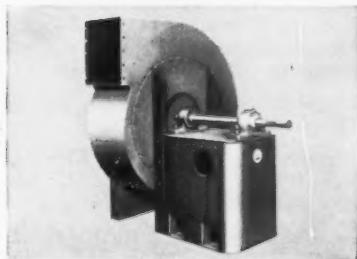


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RUGASOL F . . . is painted directly on formwork. When forms are stripped (in 2 to 5 days), the retarded mortar is removed with a jet of water or stiff brush.

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For complete information on Rugasol, call or write for Bulletin RG-58.

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Julius J. Koffler, Consultant. (civil, struc., mech., elec.) Client, Newark Housing Associates, Inc.

DISTRICT OF COLUMBIA

Karsunky, Weller and Gooch
Washington, D.C.

Air conditioning and refrigeration plant, Department of Agriculture, South and North Buildings, Washington, D.C. (civil, struc., mech., elec.) \$8.5 million. Client, General Services Administration, Region 3, Washington, D.C.

Sibley Memorial hospital, Washington, D.C. (mech., elec.) \$6.5 million. Client, Justement, Elam and Darby, Architects.

FLORIDA

Brockway, Weber & Brockway, Inc.

West Palm Beach, Florida
Westward expansion of the City of West Palm Beach. 4000-acre residential, commercial, and industrial development, including land planning, earthwork, sewage collection, water distribution, storm drainage, paving, bridges, street lighting. Westward Developers Associates, Inc., developers of project. (civil, struc., mech., elec.) \$20 million. Client, City of West Palm Beach.

Seminole Estates, Palm Beach County, Fla. 1400-home subdivision, land planning, earthwork, water supply, sewage treatment, sewage collection and water distribution, paving, and drainage. (civil, struc., mech., elec.) \$1.8 million. Client, Keller Construction Company.

C. B. Arbogast, Jr.
Stuart, Florida

North River Shores subdivision, Stuart, Fla. Streets, drainage, canalizing. (civil, struc.) \$250,000. Client, North River Shores, Inc.

Gerald T. Spolter

Miami Beach, Florida
Motel, Tampa, Fla. 106 rooms, two-story, concrete frame and floor slabs, steel framing over public areas, pile foundation. (struc.) \$600,000. Client, C. B. Schoeppl, Arch.

Bishop & Johnson, Inc.

Tallahassee and Tampa, Florida
State agency building, Tampa, Fla. (civil, struc., mech.) \$1,250,000. Clients, James H. Kennedy, McLane & Ranon, Robert Weilage.

Post office building, Monticello, Fla. (civil, struc., mech., elec.) \$266,000. Client, Barrett, Daffin & Bishop.

Renovation of Lee Hall, Florida A&M University, Tallahassee, Fla. (civil, struc., mech., elec.) \$450,000. Client, Barrett, Daffin & Bishop.

Florida A&M University, Tallahassee, Fla. Extensions to campus utilities. (civil, mech., elec.) \$315,000. Client, Guy C. Fulton, Architect to the Board of Control, Gainesville.

Florida State University, Tallahassee, Fla. International student house. (civil, struc., mech., elec.) \$180,000. Client, Barrett, Daffin & Bishop.

Van Wagenen, Taylor and Van Wagenen

Jacksonville, Florida

Atlantic Coastline Railroad Co., Jacksonville, Fla. 15-story general office building, air conditioning, plumbing, cafeteria, fire protection, electrical, railroad communication system control center. (mech., elec.) \$10 million. Client, Kemp, Bunch and Jackson, Arch.

Tampa Coca-Cola Bottling Co., Tampa, Fla. 1-story, 70,000 sq ft bottling plant, plumbing, heating, electrical, and air conditioning. (mech., elec.) \$800,000. Client, Elio C. Fletcher, Architect.

Insurance Company of the South, Jacksonville, Fla. 4-story home office building, air conditioning, plumbing, and electrical design and specifications. (mech., elec.) \$1 million. Client, Kenyon W. Drake and Associates, Arch.

First National Bank, Orlando, Fla. 10-story bank and office building, air conditioning, plumbing, fire protection, electrical, and food service equipment. (mech., elec.) \$3.5 million. Client, Kemp, Bunch and Jackson, Architects.

ILLINOIS

Consoer, Townsend & Associates

Chicago, Illinois
Hospital. (struc.) \$600,000. Client, Sandwich, Ill., hospital board.

Hospital. (struc.) \$800,000. Client, Murphysboro, Ill.

Winston Park subdivision development, Palatine, Ill. (civil). \$2.2 million. Client, Winston Park Corp.

Joint sewer system, Park Ridge, Ill. (civil). \$800,000. Client, Village of Niles and City of Park Ridge, Ill.

Drainage system. (civil). \$1.7 million. Client, The DuPage County Conservancy.

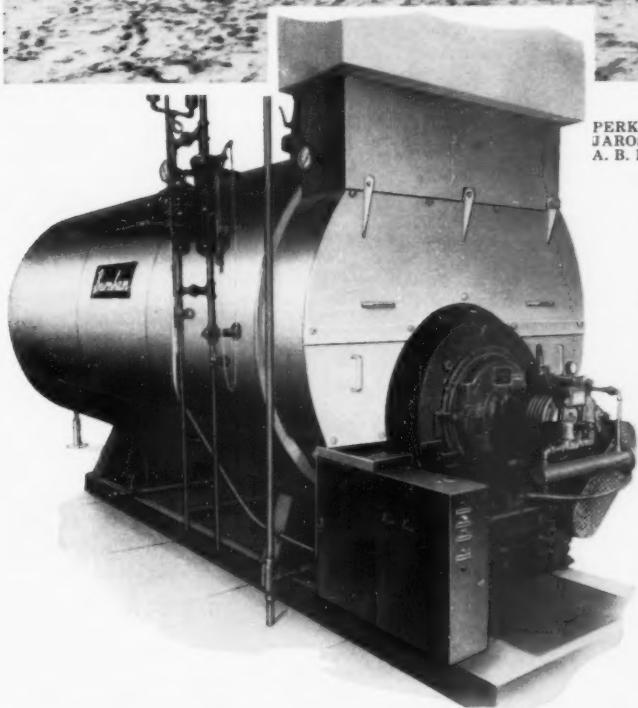
South expressway, north of 22nd St. \$8 million. Client, City of Chicago.

MODERN HEATING for a MODERN SCHOOL



Edgewood Elementary School, Scarsdale, New York

PERKINS & WILL Architects — White Plains, New York
 JAROS, BAUM & BOLLES .. Consulting Engineers — New York City
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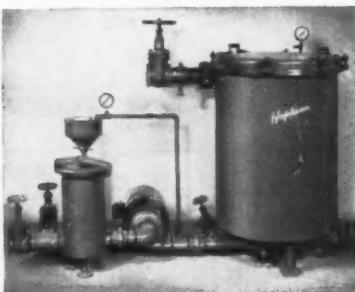
Diatomaceous earth, pressure-type models in sizes for all pools private and commercial. For full information and specifications write for Bulletin N-356.

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Dunlap-Esgar, Inc.
Chicago, Illinois
60,000 sq ft headquarters and combination development-production plant, Palatine, Ill. \$1 million (est.) Client, Elgin National Watch Co.

W. E. Weitman & Company
Chicago, Illinois

East Thornton high school, Dolton, Ill. Forced hot water heat, ventilation by means of plenum ceilings, recessed lights. 6 buildings, campus type. (mech., elec.) \$5 million. Client, Samuelson & Sandquist, Arch.

McClure junior high school and Franklin elementary school additions. \$600,000. Client, Samuelson & Sandquist, Arch. Western Springs, Illinois.

Thomas L. Higgins Associates, Inc.
Chicago, Illinois

St. Pancratius Church, Chicago, Ill. 30,000 sq ft, seating capacity, 1200. Air conditioned. (civil, struc., mech., elec.) \$700,000. Client, Catholic Bishop of Chicago.

Parkview school addition, Morton Grove, Ill. 7 classrooms, speech therapy room, and health facilities room. 71 x 165-ft. Masonry construction. (civil, struc., mech., elec.) \$143,065. Client, Board of Education, School District 70, Cook County, Ill.

Four schools: Melrose Park (new 10-classroom school); Westdale (8-classroom); Mannheim school (4-classroom and basement); and Scott school (6-classroom). (civil, struc., mech., elec.) \$640,000 total cost (est.). Client, Board of Education, School District 83, Cook County, Ill.

B. J. Hooper school, Lake Villa, Ill. 10-classroom, kindergarten, office, kitchen, and tea lounge. (civil, struc., mech., elec.) \$184,237. Client, Board of Education, School District 41, Lake County, Ill.

R. J. Abramson & J. M. Klipp
Chicago, Illinois

Villa Moderne Hotel, Cook County, Ill. 100-room hotel, indoor-outdoor swimming pools, skating rink, restaurant, barber and beauty shops. Completely air conditioned. (mech., elec.) \$1.8 million, total cost. Client, Sidney H. Morris & Associates.

Pereira & Associates
Chicago, Illinois

One-story building, Dolton, Ill. (struc., mech., elec.) \$1.6 million. Client, Container Corporation of America.

One-story extension to existing steel building, Chicago, Ill. (struc., mech., elec.) \$300,000. Client, A. Finkl & Sons Co.

Charles J. McClure & Associates
Kirkwood, Missouri

St. Elizabeth hospital addition, Granite City, Ill. 100-bed annex, air condition existing and new building, plumbing, heating. (mech.) \$900,000 (mech. only). Client, Gabriel & Dulgaroff, Arch.

INDIANA

Consoer, Townsend & Associates

Chicago, Illinois
Cline Avenue viaduct, Lake County. (civil, struc.) \$2.5 million. Client, Indiana Highway Department.

Robertsdale sewer system. (civil) \$1.2 million. Client, City of Hammond, Ind.

Intercepting sewers and sewage plant. (civil, struc., mech., elec.) \$3 million. Client, New Albany, Ind.

Intercepting sewer. Addition to East Side sewage plant and trunk sewers. (civil, struc., mech., elec.) \$5 million. Client, Evansville, Ind.

IOWA

Frank L. Pulley

Des Moines, Iowa
High school building, West Branch, Iowa. (mech., elec.) \$400,000. Client, Karl Keffer Associates.

MASSACHUSETTS

**Stressenger, Adams,
Maguire and Reidy**

Boston, Massachusetts
Blue Cross-Blue Shield building, Boston, Mass. (mech., elec.) \$4.5 million. Client, Anderson, Beckwith and Haible, Arch.

MICHIGAN

G. J. McLavy & Sons
Lansing, Michigan

Highway bridge, 4 miles north of Owosso. (struc.) \$112,000. Client, Shiawassee County Road Commission, Mich.

Highway bridge, Okemos. (struc.) \$100,000. Client, Ingham County Road Commission.

Highway bridge, 4 miles northeast of Coldwater. (struc.) \$19,000. Client, Branch County Road Commission.

Highway bridge, 2 miles east of Constantine. (struc.) \$45,000. Client, St. Joseph County Road Commission.

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HIGH VELOCITY VALVE ATTENUATOR

Ensures COMPLETE CLOSE-OFF

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series "45"

The CONNOR KNO-DRAFT "series 45" Valve Attenuator offers important new advantages for dual duct installation.

The exclusive patented HELICAL NEOPRENE COATED SPRING DAMPER positively assures complete close-off . . . full cooling and heating realized because damper shuts with less than 2% leakage. Damper action is linear, and operation is extremely quiet because high velocity air is throttled through soft-walled venturis and discharged radially.

This unique damper and the precisely engineered combination of other important features makes these High Velocity Valve Attenuators matchless for constant, quiet, controlled performance.

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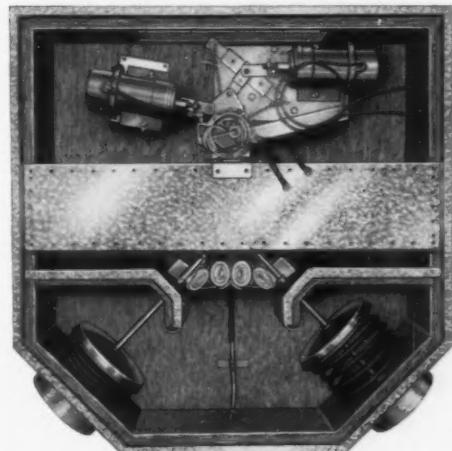
high velocity air diffusers

CONNOR ENGINEERING CORPORATION

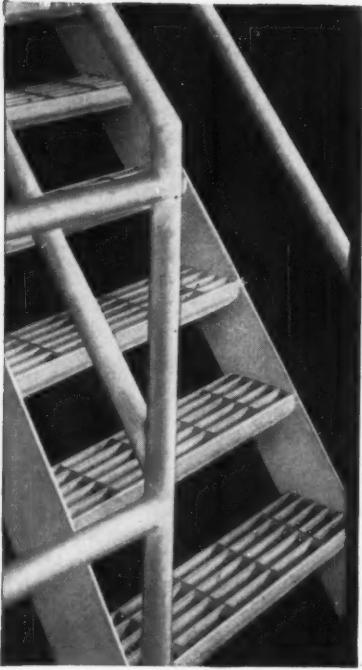
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PATENTED HELICAL NEOPRENE SPRING DAMPER throttles high velocity air by governing flow of air from supply duct into mixing chamber. Air passes from duct into mixing chamber (arrows) through spaces between spring's coils. Control mechanism compresses spring, throttling or completely closing off air flow. Aging-resistant neoprene tubing forms soft-walled venturi section when throttling . . . air-tight seal when closed.



- UNITIZED LINKAGE MECHANISM—reduces friction, eliminates control lag, insures precise temperature regulation, permits easy servicing.
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- CHOICE OF SOUND BAFFLES—Sinuous or Flat Plate.



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Hendrick Shur-Site Treads have a non-slip surface that insures safety, making them the best choice for your stairs, ladders and fire-escapes. A heavy nosing bar provides reinforcement where the load is greatest. Shur-Site Treads are constructed by a pressure forming process, and so have no angle irons, bolts or rivets to collect dirt and refuse. Their 90% open area lets in plenty of light and air.

Shur-Site Treads are available in standard sizes or in special widths and lengths. They are shipped ready to bolt directly to stair stringers.

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Shur-Site Treads • Armorgrids • Hendrick Hydro
Dehazers • Distillation Column Internals

Michigan Associates
Lansing, Michigan
Water and sewage systems, streets, and utilities for the Wurtsmith Air Force Base, Oscoda. \$500,000. Client, Corps of Engineers.

Consoer, Townsend & Associates
Chicago, Illinois
Roads and bridges, Route 12, east of Benton Harbor, Mich. (civil, struc.) \$10 million. Client, Michigan Highway Department.

John M. Graham
Bellewood, Illinois
Machine control for "Planobot" automatic hand (material transfer device). (elec.) \$5000. Client, Planet Corporation, Lansing, Mich.

MISSOURI

Charles J. R. McClure & Associates
Kirkwood, Missouri
Children's Center, St. Louis, Mo.
Juvenile courts, detention quarters, offices. Plumbing, heating. (mech.) \$160,000 (mech. only). Client, City of St. Louis.

Missouri School for Blind, St. Louis, Mo. Dormitories, administrative offices, classrooms. Plumbing, heating, and air conditioning. (mech.) \$180,000 (mech. only). Client, Pearce & Pearce, Arch.

Southeast Missouri State Teachers College, Cape Girardeau, Mo. Dormitories, dining room. Plumbing, heating, and air conditioning. (mech.) \$150,000 (mech. only). Client, R. Paul Buchmueller, Arch.

Smith & Tao
St. Louis, Missouri
Swedishborgian church, St. Louis, Mo. (elec.) \$75,000. Client, Erwin C. Schmidt, Arch.

Recreational building, Tower Grove Baptist church. (mech., elec.) \$500,000. Client, Fitch & Nicholas, Arch. Church of the Master, Florissant, Mo. (mech., elec.) \$75,000. Client, Manske & Dieckmann, Arch.

Mallinckrodt Institute of Radiology, Washington University, St. Louis, Mo. (mech., elec.) \$100,000. Client, Jamieson, Spear, Hammon & Grollock, Arch.

St. Francis hospital, Cape Girardeau, Mo. (mech., elec.) \$100,000. Client, Ralph Ranft, Arch.

Fred S. Dubin Associates
Hartford, Connecticut
Wohl Cancer Clinic, Barnes Hos-

pital, St. Louis, Mo. (mech., elec.) \$3 million. Client, Murphy & Mackey, Arch.

NEW MEXICO

Wood & DeLapp
Santa Fe, New Mexico
Missile Assembly 16. (struc.) \$400,000. Client, Kenneth S. Clark, Arch. Walker AFB Hospital. (struc.) \$1.5 million. Client, Kenneth S. Clark, Architect.

J. L. Breese & Associates
Santa Fe, New Mexico
Blue Spruce Motel, Farmington, N.M. Heating, air conditioning, and plumbing. \$400,000 (total). Client, McHugh, Hooker, Kidder & Associates, Arch.

NEW YORK

Henry J. Campbell, Jr.
Mineola, New York
Old First Church, Huntington. Addition of Sunday school and alteration of existing building. (mech., elec.) \$300,000. Client, Albert J. Graesser, Architect.

Franklin National Bank, Herricks. Completion of interior work of store building for use as bank facility. (mech., elec.) \$40,000. Client, Robert D. Nostrand, Arch.

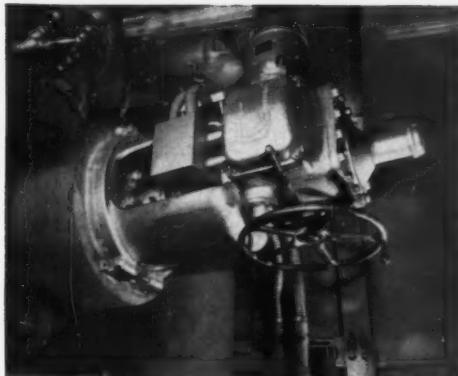
Garden City swimming pool. Addition of new outdoor swimming pool, 100' x 75-ft. (mech., elec.) \$100,000. Client, Watterson & Watson, Arch.

Franklin National Bank, Bayshore. Alteration of interior to provide centralized bookkeeping facility. (mech., elec.) \$25,000. Client, Franklin National Bank.

Donald E Stearns, P. E.
Cazenovia, New York
Water system, towns of DeWitt and Onondaga. Includes approximately 5½ miles of 6- and 8-in. cast iron main, 2 deep well pumps, and 200,000-gallon steel reservoir. \$350,000. Client, Southwood-Jamesville Water District, Onondaga County Water Authority, Agent.

Otto J. & Warren A. Sambach
Williston Park, L.I., New York
Two-story irregular shape industrial building, 41,000 sq ft., New Hyde Park, L.I., N.Y. (civil, struc.) \$600,000. Client, Majel Properties, Inc.

Two-story factory, third floor to be used as offices, New Hyde Park, L.I., N.Y. (civil, struc.) \$900,000. Client, Gordon Properties, Inc., Hannah Estates, Inc., owner-builder.



Type S-4-150 LimiTorque motorized valve control on 16" main steam stop valve, under 1880 psi and 1005°F.



8" high pressure feed water heater isolation valve with Type SM-3-60 LimiTorque motorized valve control operates at 2000 psi, 505°F.

**OPERATING
AT
1880 psi
AND
1005° F**

LimiTorque® assures safe, trouble-free valve operation

. . . at Milliken Station, the sixth and latest in the New York State Electric & Gas Company System, LimiTorque automatic valve controls provide rapid, safe and positive valve operation for normal use or where emergency may require immediate operation from a distant point. Quick, accurate control of steam flow and maintenance is assured. No personnel is needed to manually operate valves, however, if necessary, LimiTorque can always be manually operated through a safe powerful hand wheel control.

LimiTorque Valve Controls can be mounted on any size valve in nearly any position or location. LimiTorque can be readily adapted to existing equipment with electricity, hydraulic pressure, air or high pressure natural gas used as power sources.

LimiTorque provides constant seating thrust . . . assuring an absolutely tight valve on each closure while at the same time, protecting all valve operating parts from overload. Adjustment of the torque limit switch enables operating personnel to compensate for valve wear throughout the life of the valve.

Insist on LimiTorque to protect your valves



On the banks of beautiful Cayuga Lake in Upstate New York, Milliken Station represents many refinements in modern steam-electric design.

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INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID MIXERS • FLEXIBLE COUPLINGS

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these Pennsylvania Plant Loca-
tion Advantages, write or call:

PENNSYLVANIA DEPARTMENT OF COMMERCE

Main Capitol Building
1099 State Street, Harrisburg, Pa.
Phone: CEdar 4-2912

Two-story warehouse and office, Garden City, L.I., N.Y. (struc., civil, mech., elec.) \$120,000. Client, Nogan Industrial Supply, Inc.

Karsunki, Weller and Gooch
New York, New York

Holland-America Line pier, New York City. (mech., elec.) \$18 million. Client, Department of Marine and Aviation, New York City.

NORTH CAROLINA

**Joe Peeler Patrick,
Consulting Engineer**
Roebuck, South Carolina
Brevard high school, Brevard, N.C. (struc.) \$800,000. Client, McDonald & Daniels, Arch.

The Harwood Beebe Company
Spartanburg, South Carolina
Waynesville, N.C. 2 mgd expansion of present filter plant. (civil) \$120,000 (est.). Client, Town of Waynesville, North Carolina.

NORTH DAKOTA

L. W. Burdick, Engineer
Grand Forks, North Dakota.
New 200,000-gallon elevated tank, feeders, mains, hydrants. Addition to present system. (civil) \$150,000. Client, City of Larimore, N.D.
New sewage disposal lagoon and associated piping. (civil) \$50,000. Client, City of Drake, N.D.

North Central Engineers
Jamestown, North Dakota.
Sewer and water systems, disposal lagoon. (civil) \$150,000. Client, Os-nabrock, N.D.

Sanitary sewers and disposal lagoon. (civil) \$60,000. Client, Mu-nich, N.D.

Sanitary sewers and disposal lagoon. (civil) \$55,000. Client, Lignite, N.D.

OHIO

The Jennings-Lawrence Company
Columbus, Ohio
Water system, Chesterhill, O. plans and specifications for water supply, elevated storage, and distribution mains for Village of Chesterhill.

Activated sludge type sewage treatment plant, Gahanna, O. Capacity to handle a population equivalent of 3000 people.

Pereira & Associates
Chicago, Illinois
One-story building, Solon, O. (struc., mech., elec.) \$1.1 million. Client, Container Corporation of America.

OKLAHOMA

Fred S. Dubin Associates
Hartford, Connecticut.

St. Gregory's Abbey, Oklahoma. (civil, mech., elec.) \$8 million. Client, Murphy & Mackey, Arch.

OREGON

James & Honey

Portland, Oregon.

Warehouse for Oregon Transfer, 100,000 sq ft, tilt-up, sprinklered. (civil, struc.) \$450,000. Project is a joint venture with Johnson & Koch, Architects.

Experimental building, Albany, Ore. (civil, struc., mech., elec.) \$350,000 (including equipment). Client, Wah Chang Zirconium Div.

Kaiser-Parmanente Hospital, Portland, Ore. (struc.) \$3 million. Client, Wolff & Zimmer, Arch.

National Guard Armory and 11-story office building, Portland. Joint venture with Jim Pierson, Engineer. (struc.) \$5 million. Client, Johnston, Johnson, Dougan & Heims, Architects.

Cornell, Howland, Hayes & Merryfield
Corvallis, Oregon.

Design interceptor sewer, pump station, and sewage treatment plant, Ranier, Ore. (civil, struc., mech., elec.) \$100,000. Client, City of Ranier, Ore.

Design sanitary sewer collection system to discharge into existing interceptor line leading to sewage treatment plant. System to serve area recently annexed to City of Medford, Ore. (civil) \$400,000. Client, City of Medford, Ore.

Design approximately 240,000 feet of sanitary sewer, together with a sewage pumping station, and sewage treatment facilities to serve estimated population of 20,000. (civil) \$1,800,000. Client, Klamath Falls, Ore., Sanitary District.

Design 12-lane bowling alley in conjunction with AMF Pinspotters, Inc., located in Reedsport, Ore. (civil, struc., mech., elec.) \$58,000 (est.) Client, Lee Kellison.

Design cold storage warehouse, Cor-vallis, Ore. (civil, struc., mech., elec.) \$210,000 (est.) Client, Modern Freezing and Storage.

Western Engineering Consultants
Eugene, Oregon.
Semi-ambulatory unit, Oregon Fairview Home, Oregon State Board of Control. (struc.) \$240,000. Client, Wilmsen & Endicott, Arch.



Man and boy at right dramatize size of this 80' x 360' Stran-Steel building owned by West Jersey Warehouses, Inc., of Bridgeton, N.J. Here is 28,800 square feet of working space.

MASS-PRODUCED FOR SAVINGS... CUSTOM-FITTED TO YOUR NEEDS!

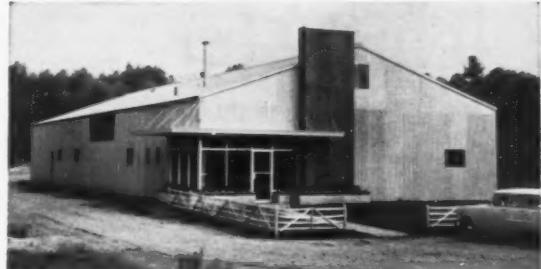
In your next building—factory, warehouse, or retail outlet—get these three big benefits: 100% useable clear-span interior, firesafe all-steel construction and a 5-year payment plan. They're all yours with a Stran-Steel Rigid Frame building!

Wide-Open Interiors Fit Any Floor Plan

The Stran-Steel method of construction means you get top design flexibility. Mass-produced components give you major economies and, at the same time, permit you to tailor your building to the size, function and appearance you specify. Insulates easily, takes cranes or monorails, combines effectively with other materials—like brick, masonry, wood and glass. And Stran-Steel's precision pre-engineering means your site-assembled building goes up in days, stays up for decades with minimum upkeep and operating expense.

Only One-Fourth Down as Your Initial Investment

Without affecting your regular credit lines, you can buy this versatile, durable building through the Stran-Steel Purchase Plan. Pay as little as one-fourth down for the completed structure—including foundation, erection cost and tax—with as long as five years for the balance. Your building works for you as you pay. Mail the coupon now for more information or call your Stran-Steel dealer. He's listed in the Yellow Pages under *Steel Buildings* or *Buildings—Steel*.



Good-looking, hard-working manufacturing plant for Standard Fence Co., Manchester, N.H. Stran-Steel factories can be expanded easily when you need more production space.



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Stran-Steel Corporation, Dept. 26-19
Detroit 29, Michigan

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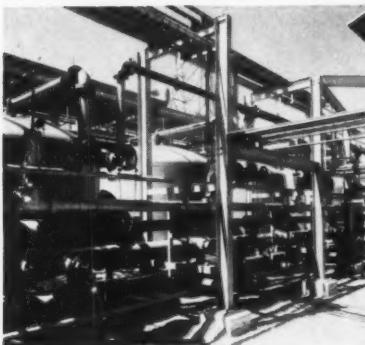
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filters



FOR PRODUCTION OF ClearWater

In the design and manufacture of water-treating equipment, it often becomes necessary to include a filter of some type in the line-up in order to insure clarity and cleanliness of the water going to the next step. The picture above shows a large filter installation (in this case, at an outdoor location), one of many we have planned and produced to meet particular conditions or situations.

DIFFERENT TYPES MANY APPLICATIONS

The filters we make may be any of the various types usually associated with the cleaning of water. Possible applications are numerous and may include such functions as removal of iron, rust, and manganese, removal of turbidity and suspended solids, clarification of lime-softened water, removal of free chlorine, organic matter, tastes, and odors, and various other special filtering requirements. Whatever filters are needed in a water-treatment system, we are prepared to produce them.



ILLINOIS WATER
TREATMENT CO.
840 Cedar St.
Rockford, Ill.

NEW YORK OFFICE: 141 E. 44th St., New York 17, N.Y.
CANADIAN DIST.: Pumps & Softeners, Ltd., London, Ont.

**Stressenger, Adams, Maguire
and Reidy**

Boston, Massachusetts

Portland Sheraton Hotel, Portland, Ore. (mech., elec.) \$4.5 million. Client, Perry, Shaw, Hepburn and Dean, Arch.

PENNSYLVANIA

William F. Bell, Consulting Engineer
Pittsburgh, Pennsylvania.

Kopriv shopping center, Duquesne, Pa. 50,000 sq ft, constructed of masonry and steel. Main tenants, Kroger super market, Thrift drug store, and 11 smaller stores, all equipped with covered parking areas adjacent to stores. Joint venture with Gabriel Plans Service, Pittsburgh. (civil, struc., mech., elec.) \$400,000. Client, Mayor Kopriv.

Wm. R. Jahnke, Consulting Engineer
Pittsburgh, Pennsylvania.

Menzie Dairy addition, McKeesport, Pa. (mech., elec.) Client, G. Simons, Arch.

Fike Dairy. (mech., elec.) \$175,000. Client, E. Johnson, Arch.

William H. Glasgow
York, Pennsylvania

McKinley elementary school. 14-classroom addition. Prepare mechanical, design, specifications, plans. \$400,000. Client, Hamme & Lenker, Architects.

Outdoor Club, York. Prepare mechanical design, specifications, plans. \$500,000. Client, Associated Architects & Engineers.

Boys' dormitory, Gettysburg College. Prepare mechanical design, specifications, plans. \$400,000. Client, J. Alfred Hamme & Associates.

Student Union Building, Gettysburg College. Prepare mechanical design, specifications, plans. \$900,000. Client, J. Alfred Hamme & Associates.

Weiglestown elementary school. 14-classroom, campus type. Prepare mechanical specifications, designs, plans. \$350,000. Client, C. L. Forrer & Associates, Arch.

North Gate shopping center, York, Pa. 9-unit structure. Prepare mechanical design, specifications, plans. \$1 million. Client, George Flickinger, Architect.

Daniel Koffler and Associates
New Castle, Delaware

Davisville Baptist church, Southhampton, Pa. Three-story and basement addition of steel and masonry

with slabs of corrugated metal and concrete. (struc.) \$60,000. Client, Sabatino and Fishman, Arch.

Godfrey Engineering
Washington, Pennsylvania

Fire department building, North Charleroi, Pa. (mech., elec.) \$100,000. Client, B. D. Trnavsky, Arch.

Fire department building, Charleroi, Pa. (mech., elec.) \$300,000. Client, B. D. Trnavsky, Arch.

RHODE ISLAND

C. W. Riva Company

Providence, Rhode Island

North Smithfield expressway. 5.5 miles, four-lane, limited access divided highway, including 10 bridge structures over local roads, railroad, and river. (civil) \$7 million. Client, State of Rhode Island.

SOUTH CAROLINA

The Harwood Beebe Company

Spartanburg, South Carolina

Clinton, S.C. 3 mgd water filtration plant, 9½ miles of 16-in. pipeline, river pumping station, and additional distribution mains. (civil) \$1 million (est.). Client, City of Clinton.

J. C. Harrison

Spartanburg, South Carolina

Spartanburg senior high school. (mech.) \$2.5 million. Client, Spartanburg city schools.

TENNESSEE

Reese & Jackson

Nashville, Tennessee

Tennessee State Fair. New buildings, \$2.5 million. Roads, bridges, etc., \$150,000.

Green Hills office building project. \$3 million.

State of Tennessee. Clover Bottom home. Heating plant. \$260,000.

School for Girls, Tullahoma, Tenn. \$85,000.

Davidson County School. \$250,000.

Tennessee national guard wing building. \$700,000.

TEXAS

Smith & Tao

St. Louis, Missouri

New dial building, San Antonio, Texas. (struc.) \$200,000. Client, Southwestern Bell Telephone Co.

The Fluor Corporation, Ltd.

Los Angeles, California

Engineer and construct 75 million

Higher Voltage Distribution Reduces Costs

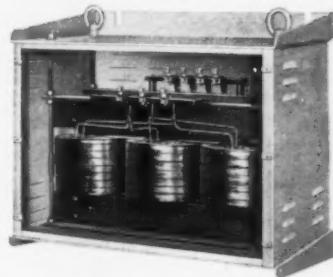
This is best accomplished in new buildings and modernization projects, by installing SORGEL dry-type transformers at load centers, using higher voltage feeders.

ALL Sorgel dry-type transformers are so quiet that they can be installed in any convenient place, thus assuring the most efficient distribution, best voltage regulation, and lowest wiring cost — in institutional, commercial and industrial buildings.

COST LESS TO INSTALL, because they are all self-contained in a single unit — either single phase or 3-phase — equipped with substantial wall brackets or floor mounting base. No separate brackets to make or buy. Easily accessible, roomy connection compartment, with wide choice of knockouts. Solderless terminals.

LIBERAL DESIGN, HIGH EFFICIENCY. SORGEL dry-type transformers are guaranteed to carry their full rated load continuously at high efficiency. They are so liberally designed that they can carry an overload during an emergency at a safe operating temperature. Vacuum impregnated windings brazed to solderless terminals assure years of trouble-free service.

*Available in all standard and intermediate ratings and voltages,
1/4 to 3000 Kva, and from 120 volts to 15,000 volts.*



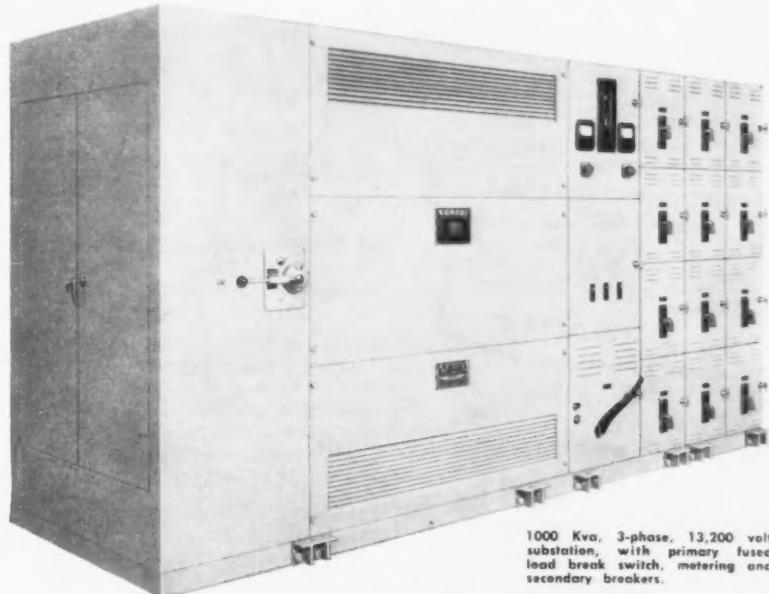
15 to 50 Kva 3-phase, 480 to 208Y/120 volts.
Wall mounting transformer.
Connection compartment panel removed.

Substation transformers

The same quiet Sorgel transformers, in ALL ratings up to 3000 Kva and up to 15,000 volts, are also incorporated in substations. Procurable with any type or make of switchgear, and from any substation manufacturer.

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TRANSFORMERS

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40 years' experience in the development, manufacturing and application of transformers

FIRST STEEL MESH DECK

Still Making History!



The first installation of an open steel grid flooring on any bridge in the world was made in 1932, on the University Bridge, Seattle, Washington, by the Irving Subway Grating Co. The previous solid pavement on the bridge had been plagued by frequent repairs and accidents.

After 24 years this decking is still in service on the Seattle Bridge. It has had no major repairs and has never even been painted. Not a single accident has occurred due to the bridge flooring.

Since then, 80% open Irving Decking has been used advantageously on hundreds of other bridges.

This remarkable record of service speaks for itself.

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Write for complete information on
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"A Fitting Grating
for Every Purpose"

IRVICO

IRVING SUBWAY GRATING CO., Inc.
Originators of the Grating Industry

Offices and Plants at
5056 27th St., LONG ISLAND CITY 1, N. Y.
1856 10th St., OAKLAND 23, CALIFORNIA

cf gas treating and dehydration plant, McMullen county, Texas. \$2 million (est.). Client, Trans-continental Gas Pipe Line Corp.

Jessen, Jessen, Millhouse & Greeven
Austin, Texas.

Engineering building, Austin. Four floors, basement, reinforced concrete frame, laboratory and classroom space. High velocity double duct air conditioning system 480/-277 v electrical system, total load 1000 kva. (struc., mech., elec.) \$2 million. Client, University of Texas.

College building program, Kingsville, Texas, consisting of engineering, agriculture, physics, and fine arts buildings and central boiler plant. 250 tons air conditioning, approximately 1000 ft tunnel piping, d-c electrical distribution in physics building, total electrical load approximately 750 kva. (mech., elec.) \$2.5 million. Client, Texas College Arts & Industries.

Karbach & Engel

San Antonio, Texas.

100-bed hospital addition, McAllen Municipal Hospital, McAllen, Texas. (mech., elec.) \$800,000. Client, R. Newell Waters, Arch.

Madera-Font Consulting Engineers

El Paso, Texas.

Golden Age Center Building addition, El Paso, Texas. (civil, struc., mech., elec., arch.) \$30,000. Client, City of El Paso, Texas.

New swimming pool, bathhouse, Washington Park, El Paso, Texas. (civil, struc., mech., elec., arch.) \$40,000. Client, City of El Paso, Texas.

New headquarters for Park Department. (civil, struc., mech., elec., arch.) \$45,000. Client, City of El Paso, Texas.

M. R. Mitchell & Associates

San Antonio, Texas.

Storm drainage project. (civil) \$480,000. Client, City of San Antonio.

Storm drainage project. (civil) \$500,000. Client, San Antonio City.

Halsey & Royer

San Antonio, Texas

Jewish community center. (mech., elec.) \$321,430. Client, M. G. Simons.

St. Joseph's School. (mech., elec.) \$63,016. Client, Julian & White, Arch.

St. Peter Prince of the Apostles Church. (mech., elec.) \$177,721. Client, Julian & White, Arch.

Kelly Air Force Base restaurant air

conditioning. (mech., elec.) \$76,500. Client, Owner.

Mission Valley Mills, Inc. substation (elec.) \$157,000. Client, Owner.

Victoria High School plant. (mech., elec.) \$1,426,000. Client, Paul G. Silver, Sr., Arch.

Osteopathic hospital. (mech., elec.) \$355,256. Client, Dukes & Williams.

Travis Park Methodist Church. (elec.) \$1,040,000. Client, Ralph Cameron, Arch.

Palmros Engineering Company

Fort Worth, Texas.

Medical arts building, Houston Endowment, Inc., Fort Worth. 500 tons air conditioning. (struc., mech., elec.) \$600,000. Client, Jesse H. Jones Interests, Houston, Texas.

Fire station (crash), Bergstrom Air Force Base, Austin, Texas. (civil, struc., mech., elec.) \$130,000. Client, U.S. Government.

UTAH

Western Engineers, Inc. and
Edwards and Kelcey

Salt Lake City, Utah

Design of interstate highway, Provo to Lehi. (civil) \$25 million (est.). Client, State of Utah.

VIRGINIA

Herbert Manuccia, P.E. & Associates
Washington, D.C.

St. Dunstan's Episcopal Church, McLean, Va. (struc.) \$100,000. Client, Don Olivola, Arch.

Office building. (struc., mech., elec.) \$250,000. Client, Western Pacific Insurance Co.

Office building. (struc., mech.) \$150,000. Client, Ron Campbell, Arch., Prudential Insurance Co., Owners.

WASHINGTON

U. S. Associates

Seattle, Washington

Addition of second floor and new structures. (civil, struc., mech., elec.) \$68,000. Client, Seattle Disposal Co.

N. Henry Gellert & Associates

Seattle, Washington

Ammunition supply, Larson AFB. \$600,000. Client, Corps of Engineers.

R. W. Beck and Associates

Seattle, Washington

Sewage collection and treatment facilities, Bellevue, Wash. (civil, struc., mech., elec.) \$880,000. Client, Bellevue Sewer Dist. L.I.D. 7, Bellevue.

AN AIR-CONDITIONING VALUE PACKAGE FROM YORK



NEW FAN COIL UNIT

- Easy, low-cost installation! Widest variety of mountings! Broadest selection of models in the industry!
- Entire unit covered by UL approval!
- Split-capacitor motors cut power consumption by as much as 40% . . . require fewer electrical circuits . . . have 30% greater life expectancy!

Here's good news from York: a packaged fan coil unit that combines important engineering advances with real benefits of interest to mechanical contractors and consultants.

WIDER SELECTION! York is the only manufacturer offering a choice of floor, wall, and ceiling-mounted units . . . with decorative casings or furred-in enclosures. There are 20 models to choose from — the longest line in the industry.

SIMPLER INSTALLATION! Water supply, return and drain lines are the only piping required. No ductwork or central air equipment, of course. S.A.E. coil connections mean no sweat soldering. Left or right-hand hookups are interchangeable in the field. Wall and ceiling-hung units eliminate problems of levelling, carpet cutting and baseboard changes. Units and casings slide onto special hanger rails in seconds. There's no exposed wiring; flexible steel conduit is used throughout.

TOP-QUALITY PERFORMANCE! The UL label covers every model. Few competitive units offer this assurance of trouble-free service. Permanent split-capacitor motors are standard in York fan coil units. Their reduced power consumption permits more units per electrical circuit, fewer circuits per building. They run quieter, cooler, slower . . . assuring longer unit life, less maintenance.

THE PRICE IS RIGHT! From the moment York fan coil units arrive on site, they start saving time, money and headaches . . . for you and your client! That's because York designs with the *real cost* of air-conditioning in mind. The features listed above are just a few of the many you'll want explained in detail. Consult your classified directory for the name and address of your local York sales representative . . . or write for Bulletin I-216, York Corporation, York, Pa.

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IN CANADA: CANADIAN ICE MACHINE COMPANY LTD., TORONTO

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Live Better
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LO-BOY CENTRIFUGAL ROOF EXHAUSTERS

**Enhance The Beauty
Of Building Skylines**



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Lowest Silhouette Design FORWARD OR BACKWARD CURVE WHEEL WITHIN . . . OR OUT OF SCROLL HOUSING

Motor mounting on side of structure support . . . out of line of air stream reduces height of Lo-Boy models nearly 50% of older designs.

LOW WIND RESISTANCE SIZES 10"-72"
600-47,000 CERTIFIED C.F.M. RATINGS

- QUALITY ● BEAUTY
- PROVEN PERFORMANCE

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AMMERMAN CO., INC.

110 North Second St.
Minneapolis 1, Minnesota
MEMBER OF THE AIR MOVING &
CONDITIONING ASSN.

WEST VIRGINIA

Irving Bowman and Associates

Charleston, West Virginia
Radio Astronomy Observatory, Green Bank, W.Va. Site development, utilities, and buildings. (civil, struc., mech., elec.) \$2.5 million. Client, Associated Universities, Inc.

Telephone buildings at Holden, Omar, Delbarton, W.Va. (civil, struc., mech., elec.) \$132,000. Client, Chesapeake & Potomac Telephone Company.

Telephone dial building, Sutton, W.Va. \$133,000. Client, Chesapeake & Potomac Telephone Co.

Chemical unit for silicones plant, Long Beach, W.Va. (civil, struc., mech., elec.) \$500,000. Client, Silicones Division, Union Carbide Corp.

Service buildings, chemical plant, Putnam County, W.Va. (civil, struc., mech., elec.) \$2 million. Client, Union Carbide Chemicals Co., Division Union Carbide Corp.

Charles W. Stewart, Structural Engineer

Huntington, West Virginia

Bank building, Ceredo, W.Va. 1-story, brick, 11,000 sq ft, contemporary design. (struc.) \$250,000. Client, First National Bank of Ceredo.

Concrete block storage building, Kenova, W.Va. 1-story. (civil, struc., mech., elec.) \$13,000. Client, Kenova Terminal Co.

Post office building, Bluefield, W.Va. 4-story concrete frame and brick. Steel frame for remodeling existing structure. 10,000 sq ft per floor. (struc.) \$700,000. Client, Frampton & Bowers, Arch.

WISCONSIN

J. D. Hurley Engineering Service Milwaukee, Wisconsin

Lakeland subdivision. (civil). \$40,000. Client, Val Zimmermann.

Residence and carport. (civil, struc., mech., elec.) \$25,000. Client, Robert E. Morrell.

Kenneth F. Lemke

Shawano, Wisconsin

Telephone building and garage, Shawano. (struc., mech., elec.) \$250,000. Client, Dairyland Telephone Company.

Consoer, Townsend & Associates

Chicago, Illinois
Roads and bridges. (civil, struc.) \$10

million. Client, Wisconsin Highway Department.

Filtration plant. (civil, struc., mech., elec.) \$4 million. Client, City of Fond du Lac, Wis.

WYOMING

Noah E. Wolford

Encampment, Wyoming
Evaporation lagoon and sanitary sewer system. (civil) \$60,000. Client, City of Encampment.

FOREIGN

Robert S. Loomis, Engineers

Windsor, Connecticut
Montego Bay hotel addition, British West Indies. \$250,000. Client, Adam & Lee, Arch.

Pereira & Associates

Chicago, Illinois
Office and mechanical building, Vancouver, B.C. (struc., mech., elec.) \$7 million. Client, The Pacific Press, Limited.

Stevenson & Rubens

Seattle, Washington
Pulp mill, Sitka, Alaska. (civil, struc., mech., elec.) \$55 million. Client, Alaska Lumber and Pulp Company.

John H. Ross and Associates Limited

Toronto, Ontario, Canada
Ontario Crippled Children's Centre, Toronto. (mech.) \$3 million. Client, Stanford & Wilson, Arch.

Brett-Quellette-Blauer, Associates

Montreal, Canada
Place Ville Marie — similar to Rockefeller Center — to be located in Montreal. Largest building to be a 40-story office building, 1½ million sq ft, plus shopping and cultural center covering 4½ acres. (civil, struc.) \$125,000,000. Client, Webb & Knapp (Canada) Ltd.

Harza Engineering Company

Chicago, Illinois
Two Cat Falls dams and powerhouse in Canada. \$7,500,000. Client, Great Lakes Power Co., Ltd.

Wm. R. Jahnke, Consulting Engineer

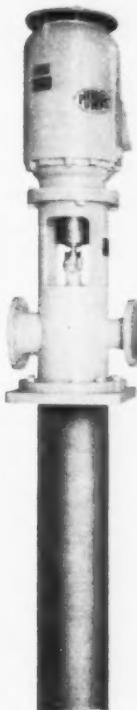
Pittsburgh, Pennsylvania
Union church and school, Punta Las Maries, Puerto Rico. (mech., elec.) \$300,000. Client, Schmidt & Medade, Arch.

James & Honey

Portland, Oregon
Kaiser-Permanente Hospital, Honolulu, T.H. (struc.) \$3 million. Client, Wolff & Zimmer, Arch. ▲▲



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Books

For the Libraries of Consulting Engineers

BASIC SOILS ENGINEERING, by B. K. Hough; The Ronald Press Company; N. Y.; 513 pp.; \$8.00.

Reviewed

by

Don V. Roberts
Quality Improvement Engineer
Dames & Moore

Soil Mechanics Engineers

The purpose of this book is to provide basic information concerning soil properties and soils behavior to engineers and stu-

dents who require only general information on this subject. It was felt by the author that most of the available texts on soils engineering contained information aimed at both the undergraduate and graduate level with the result that these texts would tend to confuse those who did not plan to specialize in this field.

Roughly one-half of the book is devoted to describing the significance and measurement of certain soil properties such as moisture, soil structure, compressibility, shearing strength, index tests, and stress distribution. These chapters reflect the results of postwar research—particularly in the discussions on the structure of cohesive soils and the relationship of this structure to compressibility characteristics of soils.

A large portion of the remainder of this book discusses the engineering applications of soil mechanics. Sections are included on the stability of unretained slopes, the lateral pressures on retaining structures, bearing pressures for spread foundations, pile foundations, settlement calculations, subgrades and paving thickness, and soil compaction and stabilization.

The concluding chapters of this book present the author's views concerning site investigations and soil testing.

In general, this book is exceptionally well organized and clearly written. The portions of the book pertaining to basic soils properties will prove to be of con-

siderable value to practicing engineers. As an example, frequent tables are used which summarize typical values for unit weights, permeability, and soil compaction characteristics.

By contrast, it is considered that the chapters on applied soils engineering may be of limited use to the practicing engineer. These chapters appear to oversimplify the problems associated with slope stability, determining satisfactory design bearing pressures for spread footings, and determining pile foundation requirements.

TECHNICAL REPORT WRITING, by James W. Souther; John Wiley & Sons, Inc.; 70 pp.; \$2.95.

Reviewed

by
John R. Mayer
Reports Editor
Ebasco Services, Inc.

Every engineer who recognizes the growing importance of communications within his profession and, more particularly, between engineers and business executives, will welcome this concise but complete treatment of the fundamentals of technical writing. Although the book does not offer any truly original material, the author has organized it well and patterned his approach to the engineering method.

By means of this "design approach" the author shows his reader how to tackle the problems of technical report writing in the same basic way he might tackle an engineering design problem. This is the feature that distinguishes this work from others on technical report writing.

The content of the book is organized into the sequential stages in writing a report. The introductory chapter explains the "design approach" to report writing and how it can be applied. Subsequent chapters then treat with each step in the process.

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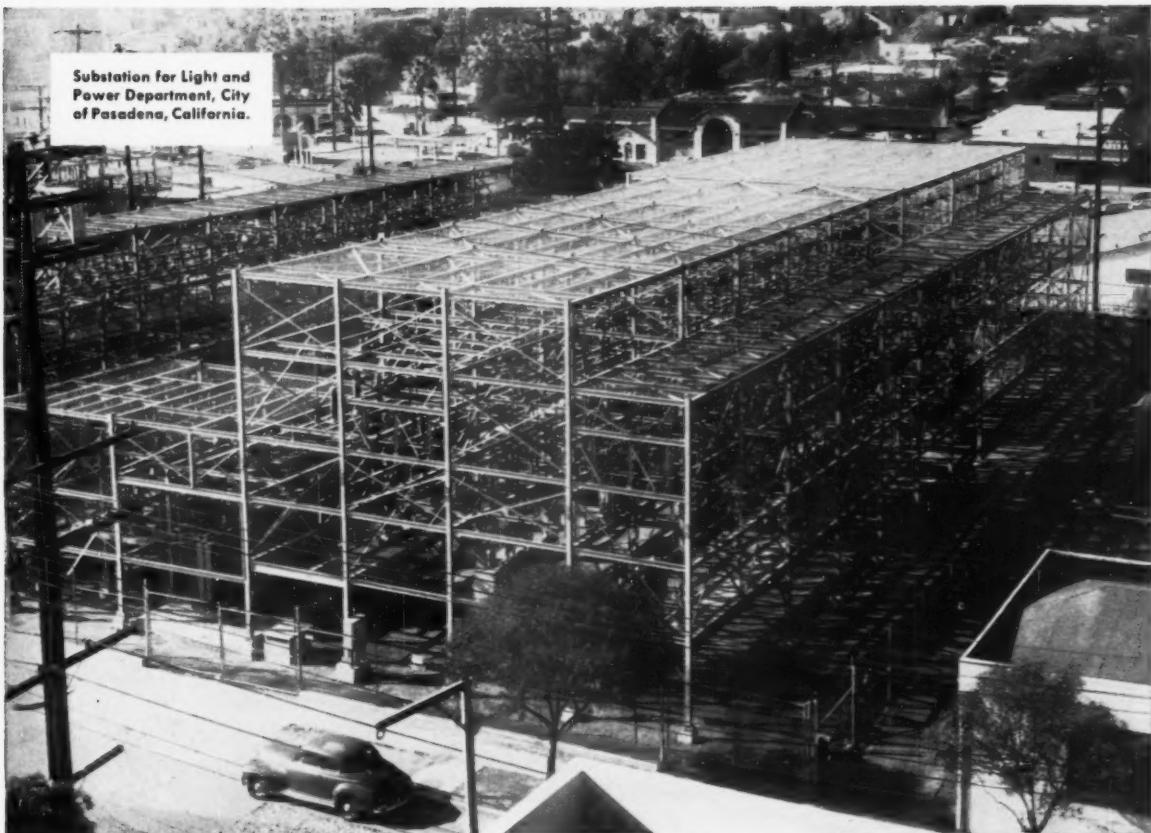
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step discussed. The author carefully demonstrates how a report is affected by the purpose it is intended to serve, and he classifies various kinds of reports by their purposes and uses. In this connection he emphasizes the importance of considering who the reader of the report will be.

The next step analyzed is the investigation of the problem with which the report deals. This step includes planning the approach to the job, gathering data and material, and evaluating this information as to its use in the report. The author then examines in detail the functional organization of the report itself. This involves selection of material to be used, weeding out duplications and unneeded detail. Methods of developing the proper organizational pattern are suggested along with principles for determining the form of the report.

The final section of the book details the actual writing of the report, from first draft to final copy. Style, layout, illustrations, and reproduction problems all are given full consideration.

Numerous books have been written on the art of report writing, but this one perhaps comes closer than any other to meeting the specific needs of consultants.

COVERED BRIDGES OF THE NORTHEAST, by Richard Sanders Allen; The Stephen Green Press; 121 pp.; \$5.95.

Why did they cover bridges? This question is answered in detail in this educational review of the origin, whereabouts, and design of American covered bridges.

The author, a consulting engineer's son and recognized authority on American covered bridges, has brought together all the elements which these landmarks play in our folklore.

Chapters are devoted to the principles of early bridge construction; to their builders, the

"unsung pioneers of engineering;" to methods and tools; and to a state by state description of the covered bridges still standing in the Northeast.

A full account is given of such bridge builders of the 1700 and 1800s as Timothy Palmer, William Howe, Theodore Burr, and Ithiel Town. The text also includes over 100 illustrations.

HOW TO DESIGN POLE-TYPE BUILDINGS, by Donald Patterson; American Wood Preservers Institute; 68 pp.; \$1.50.

This booklet is a concise, comprehensive compilation of engineering and design data on the rapidly increasing uses of pressure treated round and sawn timbers in commercial and industrial warehouses, service buildings, and other structures.

Seventeen line drawings and accompanying text show how to compute live, dead, and wind loads; and stresses for every structural member of a proposed pole-type building. An embedment chart, tables, and text enable users to make quick, dependable calculations of required pole embedment depths to handle anticipated loads and stresses.

The author, Donald Patterson, of Detroit, is a well known structural engineer and authority on pole-type construction. In this handbook he presents design procedures for proportioning structural members of pole-type buildings of all sizes, kinds, and uses.

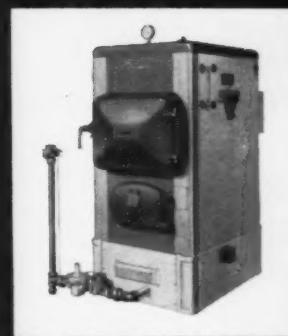
Copies of the booklet can be obtained from the American Wood Preservers Institute, 111 West Washington St., Chicago 2, Illinois.

The 1957-1959 edition of the Engineering College Research Council *Engineering College Research Review*, covering in 408 pages investigations representing more than \$100 million and the efforts of over 15,000 faculty mem-



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bers, graduate assistants, and research engineers in 110 member institutions, is now available for distribution at \$2.00 per copy. It provides an exhaustive analysis and location guide for engineering and associated science research activities and capabilities in colleges and universities throughout the country. Copies can be obtained from Renato Contini, ECRC Secretary, University Heights, New York 53, N.Y.

The American Institute of Timber Construction, are included in the appendix. The specifications also contain a table of properties of sections of the standard sizes of glued laminated members which are handy when computing member sizes.

The following publications are available from the Office of Technical Services, U.S. Department of Commerce, Wash. 25, D.C.

"Layout of Workplaces: Chapter 5 of the Joint Services Human Engineering Guide to Equipment Design," by J. H. Ely, R. M. Thompson, and J. Orlansky of Dunlap and Associates, Inc., for Wright Air Development Center, 113 pp., \$3.00, No. PB 121802.

"A Second Survey of Domestic Electronic Digital Computing Systems," by M. H. Weik, Ballistic Research Laboratories, Aberdeen Proving Ground, 439 pp., \$7.00, No. PB111996-R.

FILMS

"RANNEY METHOD," Ranney Method Water Supplies, Inc., sound and color, 12 min., 16 mm.

This interesting film shows clearly the steps involved in securing industrial water supplies by sinking of caissons. The film makes frequent reference to the importance of the consulting engineer in such a project, both at the planning stage and during construction.

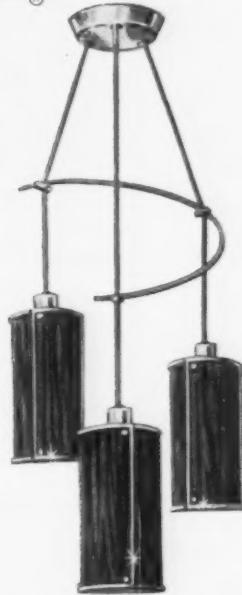
"A CUP FOR ADAM'S ALE," Gardner-Denver Co., sound and color, 33 min.

One of the 13 man-made lakes built to relieve a shortage of water in the Denver, Colo., area is shown in this film. Economics of dam building, from the widening of access roads to use of mountain ridges as sidewalls, is discussed in detail. ▲▲

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Consulting Engineers' Calendar

| Date | Sponsor | Event | Location |
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| April 8-11 | Society of Automotive Engineers | National Aeronautics Meeting | Hotel Commodore New York, N. Y. |
| April 10-11 | Illuminating Engineering Society | Northeastern Regional Conference | Statler Hotel Hartford, Conn. |
| April 14-15 | American Society of Mechanical Engineers | Maintenance and Plant Engineering Group Conference | Penn-Sheraton Hotel Pittsburgh, Pa. |
| April 14-15 | American Institute of Electrical Engineers | Conference on Rubber and Plastics | Sheraton Mayflower Hotel Akron, Ohio |
| April 14-17 | American Society of Mechanical Engineers | Design Engineering Conference | International Amphitheatre Chicago, Ill. |
| April 20-23 | American Institute of Chemical Engineers | General Meeting | Sheraton-Mt. Royal Hotel Montreal, Canada |
| April 21-23 | Building Research Institute | Annual Meeting | Shoreham Hotel Washington, D.C. |
| April 24-25 | Society for Advancement of Management and American Society of Mechanical Engineers | Management Engineering Conference | Hotel Statler New York, N. Y. |
| May 1-8 | American Society of Tool Engineers | 1958 Tool Show and Annual Meeting | Convention Hall Philadelphia, Pa. |
| May 7-11 | Western Air Conditioning Industries Association | Conference and Exhibit | Shrine Exposition Hall Los Angeles, Calif. |
| May 19-23 | National Fire Protection Association | Annual Meeting | Palmer House Chicago, Ill. |
| June 8-18 | Society of Automotive Engineers | Summer Meeting | Chalfonte-Haddon Hall Atlantic City, N. Y. |
| June 12-14 | National Society of Professional Engineers | General Meeting | Chase Hotel St. Louis, Mo. |
| June 22-27 | American Institute of Electrical Engineers | Summer General Meeting | Hotel Statler Buffalo, N. Y. |
| June 23-27 | American Society for Testing Materials | Annual Meeting and Exhibit | Hotel Statler Boston, Mass. |
| June 23-25 | American Society of Heating and Air-Conditioning Engineers, Inc., and American Society of Refrigerating Engineers | Joint Meeting | Pick-Niclet Hotel Minneapolis, Minn. |
| June 23-27 | American Society of Civil Engineers | Convention | Multnomah Hotel Portland, Ore. |

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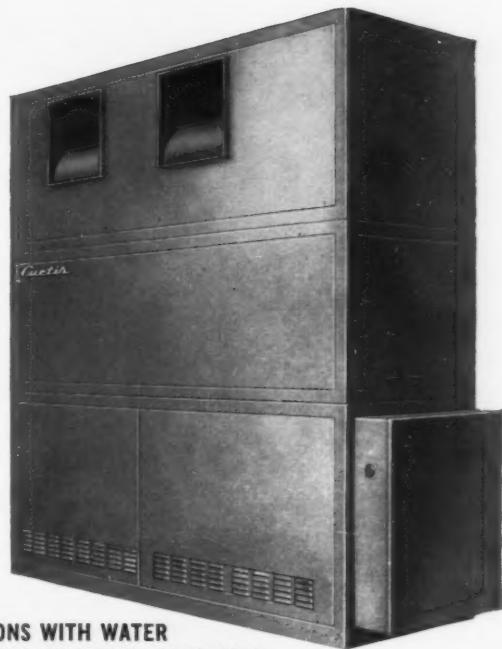
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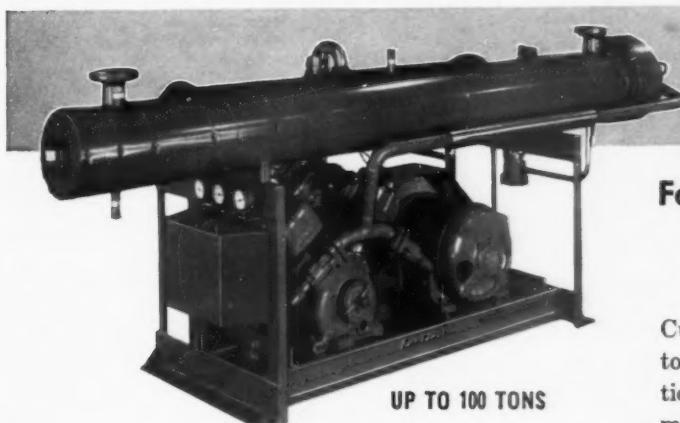
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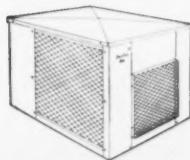
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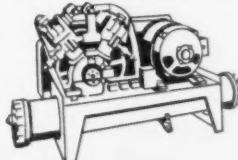
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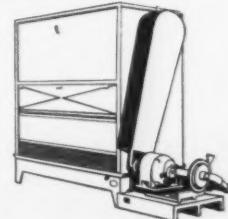
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ADVERTISERS' INDEX

| | |
|--|-------------|
| Acme Industries, Inc. | 195 |
| Advance Transformer Co. | 29 |
| Aerovent Fan Co. Inc. | 84 |
| Allis-Chalmers | |
| General Products Div. | 71-72-73-74 |
| Aluminum Co. of America | 69 |
| American Blower | |
| Div. of American-Standard | 199 |
| American-Marsh Pumps | 86 |
| Ammerman Co., Inc. | 212 |
| Anemostat Corp. of America | 67 |
| Appleton Electric Co. | 55 |
| Arrow-Hart & Hegeman Electric Co., The | 21 |
| Babcock & Wilcox Co., The | |
| Boiler Div. | 65 |
| Baltimore & Ohio Railroad | 151 |
| Barber-Colman Co. | 141 |
| Barnstead Still & Demineralizer Co. | 198 |
| Bell & Gossett Co. | 41 |
| Benjamin Electric Mfg. Co. | 45 |
| Bituminous Coal Institute | 80-81 |
| Boosey Mfg. Co., Norman | 170 |
| Borden Metal Products Co. | 83 |
| Bruner Corp. | 23 |
| Buell Engineering Co., Inc. | 224 |
| Buffalo Forge Co. | 165 |
| Burt Mfg. Co., The | 134 |
| Burnham Corp. | 201 |
| Caterpillar Tractor Co. | 85 |
| Chapman Valve Mfg. Co., The | 190-191 |
| Chicago Blower Corp. | 169 |
| Clyde Iron Works, Inc. | 57 |
| Colorado Dept. of Development | 216 |
| Combustion Engineering | 43 |
| Conco Engineering Works | 78 |
| Condenser Service & | |
| Engineering Co., Inc. | 50 |
| Connor Engineering Corp. | 101, 203 |
| Curtis Mfg. Co. | 221 |
| Day-Brite Lighting, Inc. | 35-36-37-38 |
| Dean Products, Inc. | |
| Dean Thermo-panel Coil Div. | 198 |
| Dearborn Chemical Co. | 222 |
| DeBevezat Fans, A Div. of | |
| American Machine & Metals, Inc. | 153 |
| DeLaval Steam Turbine Co. | 193 |
| Diamond Power Specialty Corp. | 63 |
| DuKane Corp. | 214 |
| Dunham-Bush, Inc. | 49 |
| Edward Valves, Inc. | |
| Sub. of Rockwell Mfg. Co. | 14-15 |
| Electrical Engineers Equipment Co. | 215 |
| Elgin Softener Corp. | 19 |
| Everlasting Valve Co. | 68 |

| | |
|-------------------------------------|-----------|
| Fairbanks Co., The | 58 |
| Gary Grating Div. | |
| Rockwell Spring & Axle Co. | 51 |
| General Electric Co. | |
| Distribution Assemblies Dept. | 6-7 |
| General Filter Co. | 136 |
| Globe Co., The | |
| Grip-Strut Div. | 42 |
| Golden-Anderson Valve Specialty Co. | 76 |
| Goulds Pumps, Inc. | 52-53 |
| Guth Co., The Edwin F. | |
| Fluorescent Div. | 61 |
| Hardinge Co., Inc. | 62 |
| Hartzell Propeller Fan Co. | 3 |
| Hawg Drinking Faucet Co. | 40 |
| Hendrick Mfg. Co. | 204 |
| Hilliard Corp., The | 24 |
| Hopkins Equipment Co. | 202 |
| Hotel Pittsburgher | 144 |
| Hotel Wolverine | 218 |
| Illinois Engineering Co. | |
| a Div. of American Air Filter Co. | 172 |
| Illinois Water Treatment Co. | 208 |
| Inland Steel Products | 18 |
| Insul-B-Corp. | 16 |
| Intrusion-Prepat, Inc. | 47 |
| Irving Subway Grating Co., Inc. | 210 |
| I-T-E Circuit Breaker Co. | |
| & IE Equipment Div. | 105 |
| Small Air Circuit Breaker Div. | 145 |
| Switchgear Div. | 4th Cover |
| Jeffrey Mfg. Co., The | 156-157 |
| Jenkins Bros. | 135 |
| Jenn-Air Products Co., Inc. | 173 |
| Johns-Manville | 32-33 |
| Johnson Co., S. T. | 144 |
| Johnson-March Corp. | 66 |
| Jordan Corp. | 218 |
| Kearns & Mattison Co. | 25 |
| Kerite Cable | 79 |
| Kewanee Boiler | |
| Div. of American-Standard | 217 |
| Kinnear Mfg. Co., The | 44 |
| Lennox Industries, Inc. | 216 |
| Leupold & Stevens Instruments, Inc. | 160 |
| Lewin-Mathes | 31 |
| Lightolier, Inc. | 77 |
| Liquidometer Corp., The | 142 |
| Magnetrol, Inc. | 10 |
| Mahon Co., The R. C. | 148-149 |
| Marietta Concrete Corp., The | 223 |

| | |
|----------------------------------|---|
| Master Builders Co., The | 3rd Cover |
| Mercoid Corp., The | 166 |
| Mesta Machine Co. | 17 |
| Michael Flynn Mfg. Co. | 196-197 |
| Minneapolis-Honeywell Reg. Co. | 177-178-179-180-181-182-183-184-185-186 |
| Moe Light Div., Thomas Ind. Inc. | 219 |

| | |
|----------------------------|-----|
| Nesbitt, Inc., John J. | 13 |
| New York Blower Co., The | 11 |
| Niagara Blower Co. | 192 |
| Northern Blower Co., The | 48 |
| Nugent & Co., Inc., Wm. W. | 154 |

| | |
|------------------------|-----------|
| Ohio Injector Co., The | 2nd Cover |
|------------------------|-----------|

| | |
|---------------------------------|-----|
| Peerless Electric Co., The | |
| Fan & Blower Div. | 176 |
| Peerless Pump Div. | |
| Food Machinery & Chemical Corp. | 213 |
| Penn Ventilator Co. | 12 |
| Pennsylvania Dept. of Commerce | 206 |
| Petro | 167 |
| Petrometer Corp. | 146 |
| Philadelphia Gear Works, Inc. | |
| Limitorque Corp. | 205 |
| Power Line Fan Co., Inc. | |
| Div. of Chelsea Products, Inc. | 56 |
| Pratt Co., Henry | 171 |

| | |
|------------------------------------|----------|
| Ranney Method Water Supplies, Inc. | 30 |
| Reznor Mfg. Co. | 70 |
| RLM Standards Institute, Inc. | 4 |
| Rockwell Co., W. S. | 162, 164 |
| Roots-Connerville Blower | |
| a div. of Dresser Industries, Inc. | 147 |
| Roper Hydraulics, Inc. | 22 |

| | |
|--|----------|
| Sier-Bath Gear & Pump Co., Inc. | 152 |
| Sika Chemical Corp. | 200 |
| Sonneborn Sons Inc., L. | 161 |
| Sorgel Electric Co. | 209 |
| Standard Electric Time Co. | 163 |
| Stebbins Engineering & Manufacturing Co. | 188 |
| Stran-Steel Corp. | 207 |
| Sun Chemical Corp. | |
| A. C. Horn Co. | 142, 146 |
| Sylvania Electric Products Inc. | 189 |

| | |
|--|---------|
| Tube Turns Plastics, Inc. | 137 |
| Tubular Products, Inc. | 194 |
| U. S. Gauge Div. of American Machine & Metals Inc. | 46 |
| U. S. Steel Corp. | |
| Structural Sections | 138-139 |
| Vogt Machine Co., Henry | 158 |

| | |
|-------------------------------|-----------------|
| Webster Engineering Co., The | 143 |
| Weil-McLain Co. | 187 |
| Weinman Pump Mfg. Co., The | 60 |
| Wendnagel & Co., Inc. | |
| Zone Processes Div. | 168 |
| Western Boiler Co. | 59 |
| Westinghouse Electric Corp. | |
| Agency & Construction | 129-130-131-132 |
| Standard Control Div. | 174-175 |
| Sturtevant Div. | 20 |
| Wheelock Signals, Inc. | 64 |
| White Diesel Engine Div. | |
| The White Motor Co. | 155 |
| Whiting Corp. | 9 |
| Wing Mfg. Co., L. J. | 26-27 |
| W-K-M A Div. of ACF Ind. Inc. | 124 |

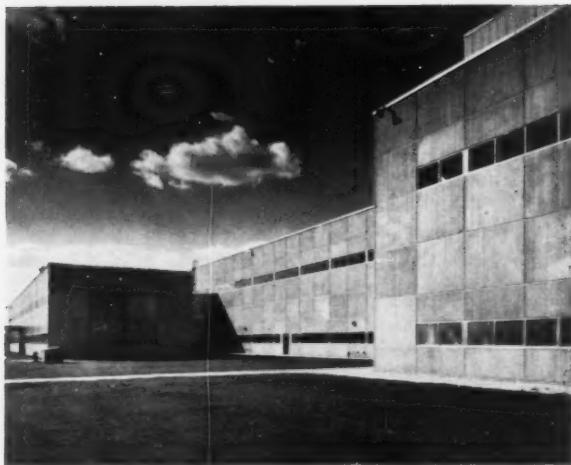
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|--------------------|-----|
| Yarnall-Waring Co. | 87 |
| York Corp. | 211 |

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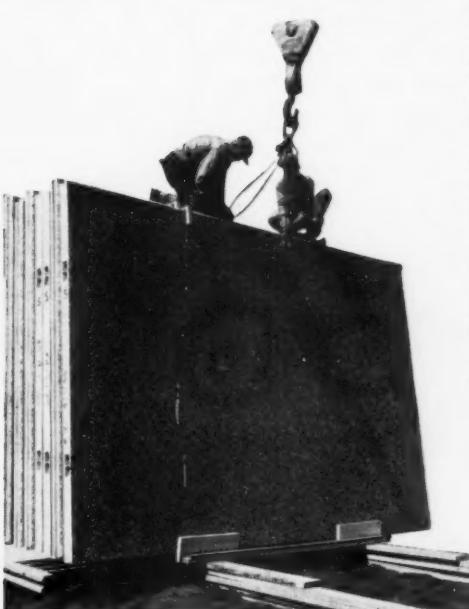
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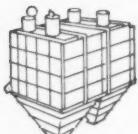
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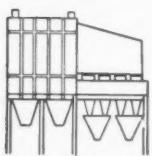
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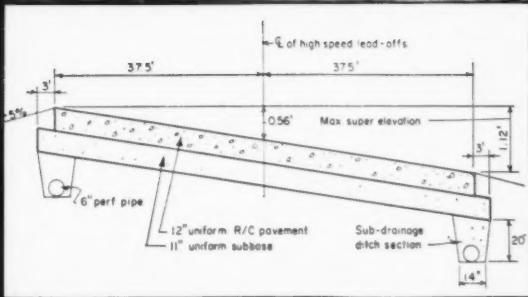
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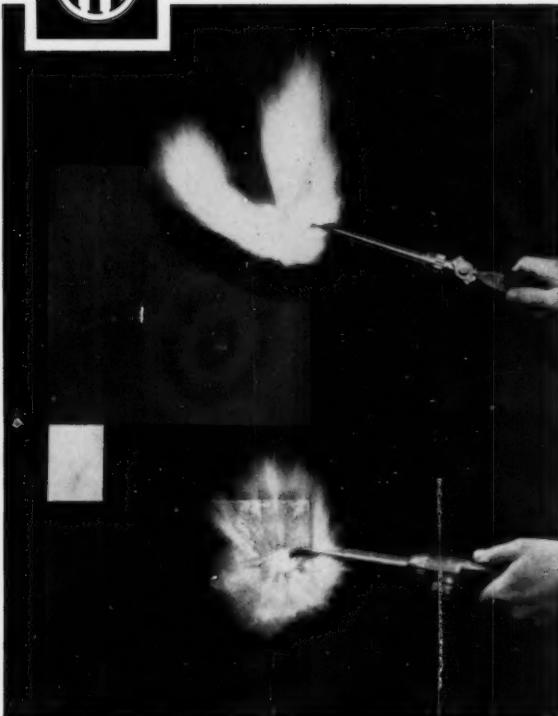
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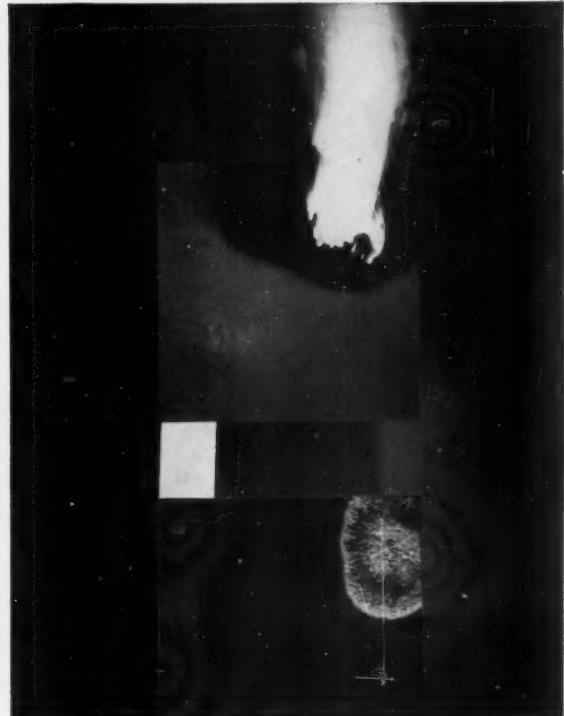
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